PROPOSED MODIFICATIONS TO STRATFORD COAL MINE
STATEMENT OF ENVIRONMENTAL EFFECTS

PREPARED BY
RESOURCE STRATEGIES PTY LTD

Project No. DC-97-01
Document No. R003-B.DOC

28 August 1998

CIM Resources Ltd
GPO Box 2587
Sydney NSW 2001

Attention: Chris Flanagan
Mining Director

Dear Chris

RE: PROPOSED MODIFICATIONS TO STRATFORD COAL PROJECT STATEMENT OF ENVIRONMENTAL EFFECTS

Please find following a copy of *Proposed Modifications to Stratford Coal Project Statement of Environmental Effects*.

Should you require further assistance with this or any other matter, do not hesitate to contact the undersigned.

Yours sincerely
RESOURCE STRATEGIES PTY LTD

CHRIS JOYCE
Principal

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EXECUTIVE SUMMARY

The Stratford Coal Mine operated by Stratford Coal Pty Ltd is located approximately 100 km north of Newcastle in NSW. The mine is an open cut operation producing approximately 1.7 million tonnes of product coal per annum. CIM Resources Ltd propose to use the Stratford Coal Preparation Plant (CPP) to process coal from the Duralie Coal Mine located 20 km to the south.

It is proposed to rail Duralie Run of Mine (ROM) coal to Stratford and unload the coal at the proposed unloading facility. The coal would then be campaign processed (separately to Stratford ROM coal) with the rejects produced being deposited in the Stratford rejects disposal system.

This Statement of Environmental Effects (SEE) was commissioned to identify any potential environmental impacts of the proposed modifications to the Stratford operation and outline mitigation methods to address these impacts.

Existing Environment

The existing environment at Stratford has been described in previous documentation for the Stratford Environmental Impact Study (EIS). The existing coal mining operation has altered the topography, soils, land capability, surface and groundwater regimes, visual character and flora and fauna of the site.

Geology

Stratford lies within the eastern flank of the Gloucester Basin which is of Permian age and contains conglomerate, sandstone, siltstone, mudstone and coal. The main Stratford deposit is classified as medium-high volatile bituminous coal and is deposited in a series of seams.

The Roseville deposit is a small reserve of some 500,000 tonnes of high quality coal. Mining of the Roseville deposit will also provide a suitable area for the disposal of reject materials from Duralie.

Project Description

The Stratford Coal Project comprises an open-cut mine based on the Stratford Main Deposit and Roseville Deposit with a coal preparation plant (CPP) and associated raw and product coal handling and rail loading facilities. The Stratford operation currently involves mining a reserve of 23.5 million tonnes (Mt) for a planned production rate of 3.4 million tonnes per annum (Mtpa) of ROM coal resulting in 1.7 Mtpa of product coal over an 8 year mine life.

It is proposed to reduce the mining rate at Stratford by 35%, from 3.4 Mtpa of ROM coal to 2.1 Mtpa of ROM coal to accommodate the inclusion of 1.3 Mtpa ROM coal from Duralie. Alterations to the existing Stratford operations to enable the importation and processing of Duralie ROM coal will entail:

- construction of additional infrastructure;
- a reduction in the Stratford mining rate;
- importation of ROM coal from Duralie; and
- disposal of Duralie rejects at Stratford.

The overall output of product coal from the Stratford CPP will remain the same (1.7 Mtpa).

Due to coal recoveries at Stratford being lower than expected and the proposal to process Duralie coal at Stratford, it is proposed to amend the currently approved rejects disposal plan to cover the remainder of mine life. The proposed amended plan involves the disposal of less reactive Stratford rejects above ground and disposal of potentially more reactive Duralie rejects below ground in the Roseville pit and Stratford Main Deposit final void.

Impacts and Mitigation

The proposed modifications to the Stratford operation have the following environmental implications:

- Reduced potential noise, air quality and blast impacts due to a 35% reduction in mining rate
- Increased rail traffic associated with the railing of ROM coal from Duralie
- Associated potential increase in rail traffic-related noise impacts
- Disposal techniques for Duralie coal rejects at Stratford need to be designed to achieve those objectives proposed and approved for the Duralie Project

Potential impacts on topography, landuse, visual features, flora and fauna, archaeology and socio-economics associated with the proposed modifications to the Stratford Project are similar to those outlined in the Stratford EIS. Mitigation measures detailed in the EIS and implemented to date are considered adequate to cover the proposed modifications.

The abovementioned modifications will, however, result in potential impacts with respect to site hydrology, acoustics, air quality and transport. Details of potential impacts and, where necessary, proposed mitigation measures are outlined in Section 5 of this document.

Rehabilitation

Rehabilitation works will be closely integrated with mine operations and will be undertaken progressively. The primary objectives of the rehabilitation programme are the control of erosion and sedimentation and reinstatement of pre-mining land capability. The existing rehabilitation programme will remain substantially unaltered. However, as the proposed modifications at Stratford include the incorporation of rejects from Duralie ROM coal processing, the rejects disposal rehabilitation programme will be refined to reflect modifications in the rejects disposal system.

Environmental Management and Monitoring

There is a comprehensive environmental management and monitoring programme in operation at Stratford which will continue for the duration of the Project. It is proposed to augment the existing water monitoring programme with additional water management elements in the Roseville pit area.

1 INTRODUCTION AND OBJECTIVES

The Stratford Coal Mine (hereafter referred to as Stratford) is owned by the Stratford Joint Venture. The current Joint Venture interests are CIM Resources Ltd (CIM) 90% and ICA Coal Pty Ltd 10%. Stratford Coal Pty Ltd (SCPL) was established as a sole purpose operating company to manage Stratford on behalf of the Joint Venture participants.

Stratford is located approximately 100 km north of Newcastle in New South Wales (Figures 1-1 and 1-2). The mine area is covered by two mining leases (ML) ML 1360 and ML 1409 and a mining lease application (MLA) MLA 94 (as shown on Figure 1-3). The mine is an open cut operation producing approximately 1.7 million tonnes per annum of high quality coking and thermal coal over an 8 year mine life. Development consent was granted for the mine on 19 December, 1994. Construction of the mine commenced in January 1995 with coal production starting in June 1995.

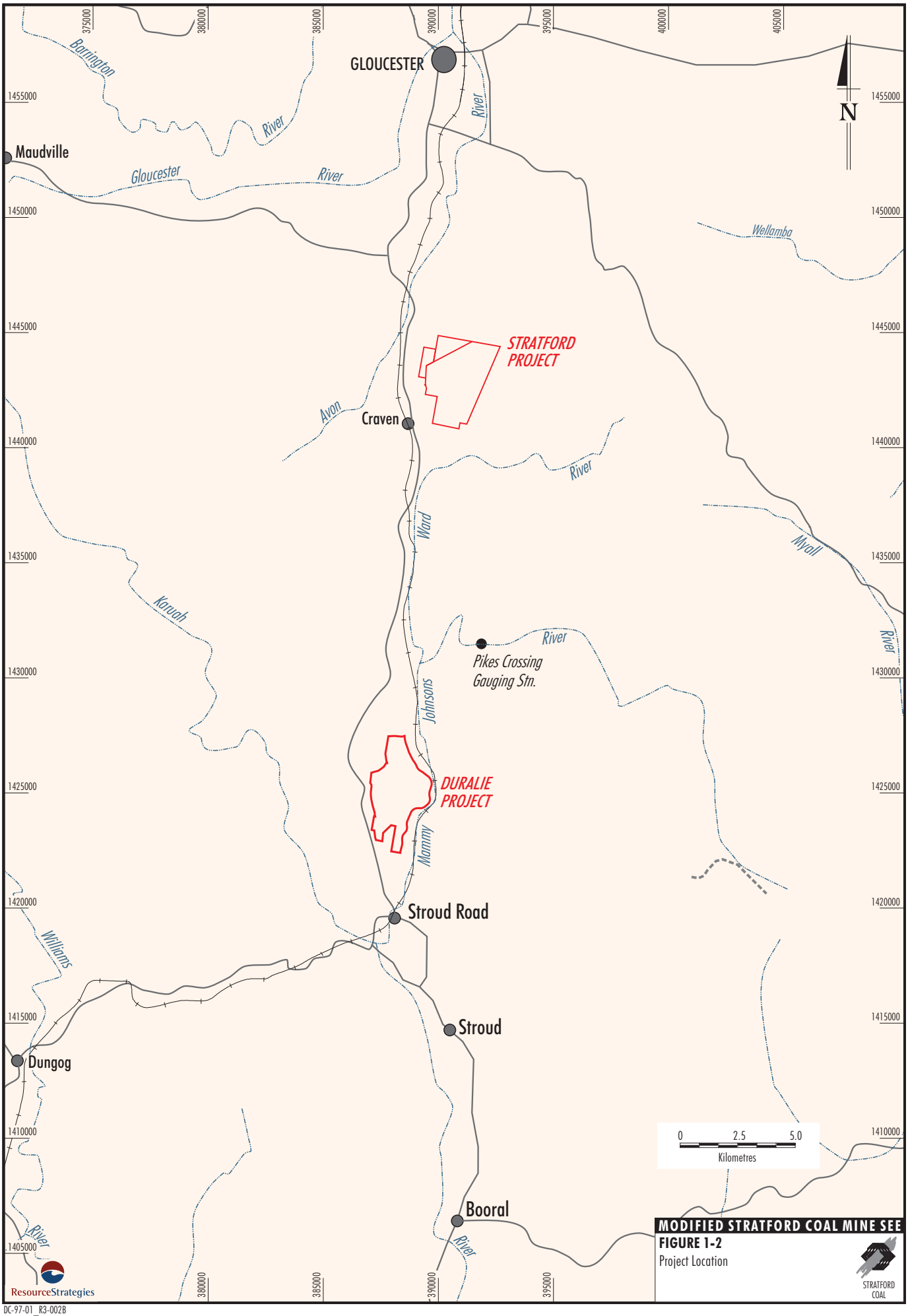
The original development at Stratford was modified under section 102 of the *Environmental Planning and Assessment Act* in July 1996. The key features of this modification were:

- development of the Roseville reserve (approximately 500,000 tonnes);
- increased rate of mining from 1.8 Mtpa to 3.4 Mtpa of ROM coal; and
- increased rate of product coal production from 1.1 Mtpa to 1.7 Mtpa.

SCPL propose to utilise the existing Coal Preparation Plant (CPP) at Stratford to process run-of-mine (ROM) coal from the proposed Duralie Coal Mine (hereafter referred to as Duralie), located approximately 20 km to the south. Under CIM's proposal Duralie ROM coal would be railed to Stratford for campaign processing, separately from Stratford coal, then railed to Newcastle for export. Duralie coal rejects generated during this process would be disposed of within the Stratford site using disposal techniques designed to achieve the same objectives as those proposed and approved for the disposal of rejects at Duralie.

CIM commissioned Resource Strategies Pty Ltd (Resource Strategies) to prepare this Statement of Environmental Effects (SEE) for the proposed modifications to the Stratford operation. This SEE has been prepared in accordance with the Department of Urban Affairs and Planning (DUAP) Best Practice Guidelines for Part 5 of the *Environmental Planning and Assessment Act, 1979* (EP&A Act) to provide an environmental assessment of the proposed modifications.


NEW SOUTH WALES
PROJECT SITE
Sydney
VICTORIA
Melbourne
350 000
400 000
450 000
N
RAILWAY
Manning River
Taree
Mt Barrington
Gloucester
COAST
1 450 000
Krambach
Nabiac
Stratford
Craven
Tuncurry
Forster
HIGHWAY
Wards River
Karuah
Project Mining Lease
Stroud Road
Dungog
Stroud
Bulahdelah
Myall Lake
Treachery Head
NORTH
Booral
1 400 000
THE BROADWATER
Limeburners Creek
PACIFIC
Karuah
Hunter River
PORT STEPHENS
MAITLAND
Hexham
NEWCASTLE
1 350 000
SOUTH PACIFIC OCEAN
Lake Macquarie
0
15
30
Kilometres
Wyong
1 300 000
ResourceStrategies
DC-97-01_R4-001B
MODIFIED DURALIE COAL PROJECT SEE
FIGURE 1-1
Regional Location Plan
DURALIE COAL



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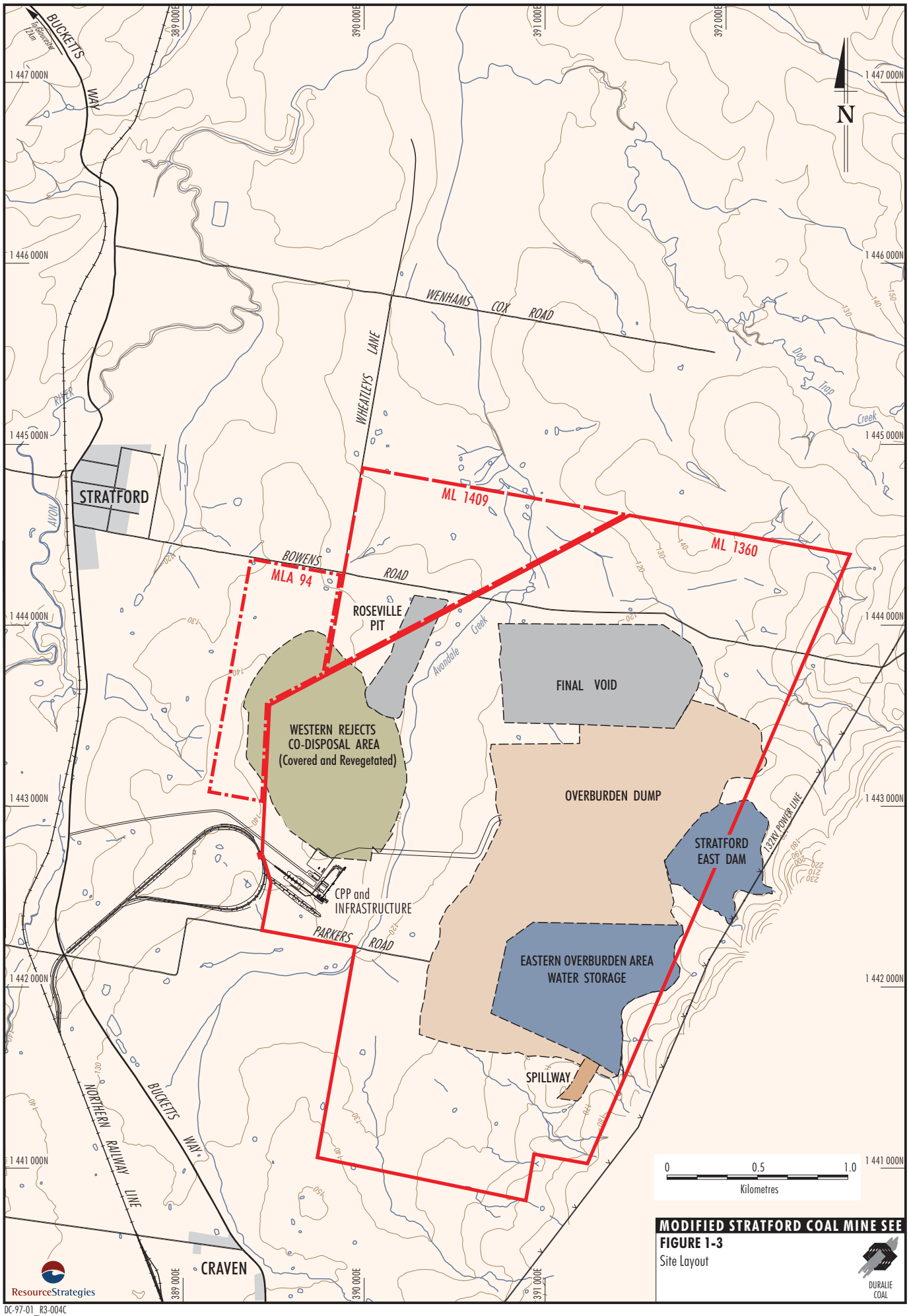


MODIFIED STRATFORD COAL MINE SEE

FIGURE 1-3

Site Layout

DC-97-01_R3-004C

The key objectives of this SEE are to:

- identify any potential impacts that the proposed modifications may have on the existing environment; and
- outline mitigation measures to be employed to minimise any potential environmental impacts.

The structure of this SEE, based on the above objectives, is as follows:

Section 1 Identifies the objectives of the report and the purpose of the modifications.

Section 2 Provides an overview of the existing environment.

Section 3 Outlines the geology of the Project area and coal resources to be utilised by the Project.

Section 4 Provides a description of the existing operation at Stratford and the proposed modifications.

Section 5 Identifies potential impacts of the proposed modifications on the existing environment and outlines proposed control measures.

Section 6 Outlines rehabilitation works to be undertaken at the site.

Section 7 Provides detail of the environmental management and monitoring programme to be implemented.

1.1 PURPOSE OF PROPOSED MODIFICATIONS

The primary purpose of the proposed modifications at both Stratford and Duralie is to make both operations more viable.

A review undertaken by CIM in late 1997 indicated that the Duralie Project under the current economic climate could only be made viable by reducing both capital and operating costs. To this end the synergistic effect of combining the existing Stratford infrastructure with the Duralie Project was investigated. Modifications to the Duralie Project would therefore result in reduced capital expenditure and operating costs by utilising existing Stratford coal processing facilities. The Stratford mining operation would be reduced in scale while still maintaining product coal targets.

The modifications at Stratford to allow the processing of Duralie coal would entail:

- construction of a new train unloading hopper;
- a new ROM stockpile and conveyor;
- reduced mining rate at Stratford (35% reduction);
- Duralie ROM coal to be campaign washed and processed at the Stratford CPP (unchanged net tonnage of export coal);
- a small extension to the product coal stockpile;
- Duralie rejects to be included in the Stratford rejects disposal system; and
- an increase of train movements to/from Stratford Coal Mine from 540 to 1,020 per annum.

1.2 LEGISLATIVE REQUIREMENTS

Environmental Assessment Approval Process

The *Environmental Planning and Assessment Act, 1979* (EP&A Act) provides for planning instruments based on the zoning of land according to its suitability for given uses. The most common planning instrument is the local environmental plan (LEP), which is prepared by a local council for all or part of a local government area.

The Stratford Project is located entirely within the local government area of Gloucester. Under the Gloucester LEP, the land comprising the Stratford Project is zoned 1(a) General Rural. Coal mining is permissible in this zone with consent.

SCPL must therefore submit a development application for the Stratford modification works to Gloucester Council (as the consent authority).

Under Part 1 of Schedule 3 of the *Environmental Planning and Assessment Regulation, 1994* (EP&A Regulation), "*coal mines*" and "*coal works*" are classified as designated development (meaning that under Part 4 of the EP&A Act, an environmental impact statement is required to be submitted along with a development application for these types of development).

It would generally be the case that the Stratford Project would fall within the category of designated development. However, item 1 of Part 2 of Schedule 3 of the EP&A Regulation relevantly provides:

> "*Development involving alterations or additions to development (whether existing or approved) is not designated development if, in the opinion of the consent authority, the alterations or additions do not significantly increase the environmental impacts of the total development (that is the development together with the additions or alterations) compared with the existing or approved development*."

In order to determine whether the proposed modifications to the Stratford Project fall within Part 2 of Schedule 3 of the EP&A Regulation, Resource Strategies Pty Ltd were commissioned by CIM to carry out an assessment of the factors which must be taken into account by the consent authority in making this decision.

The outcome of this assessment was that the proposed modifications to the Stratford Project should not significantly increase the environmental impacts of the total development compared with the existing development.

A copy of this assessment report prepared by Resource Strategies was provided to the consent authority on 20 August 1998.

As a consequence, the development application for the Stratford modification works is accompanied by this SEE (rather than an EIS).

Other Statutory Requirements

Other legislative requirements affecting the Stratford Project have been detailed in Section 1.8 of the EIS.

2 EXISTING ENVIRONMENT

The existing environment is described in detail in the Stratford EIS (Section 2). Various elements of the existing environment within and surrounding the Project area have been altered to an extent by the development of the Stratford Coal Mine. These alterations encompass the following:

- Topography and Slopes
- Soils
- Land Capability
- Surface Water
- Groundwater
- Visual Character
- Landuse
- Flora and Fauna

Water quality, air quality and acoustics/blasting impacts are monitored at Stratford and the surrounding area. The current monitoring results are available in the June 1998 Annual Environmental Monitoring Report (AEMR). The following discussion on surface water and groundwater conditions has been derived from the Stratford EIS and 1998 AEMR.

2.1 SURFACE WATER

Stratford Coal Mine is located in the Gloucester Valley and is drained by a number of small tributary creeks of the Avon River. The Avon itself is a tributary of the Manning River, which discharges to the Pacific Ocean at Taree. The mine is located on gently sloping valley floor terrain abutting a steep range of hills to the east. Avondale Creek (the main local drainage feature) traverses the site on the western side of the main pit. Avondale Creek is ephemeral although it has strong recessionary flow persistence suggestive of significant groundwater baseflow.

Surface water quality monitoring data for the Avon River indicates generally good water quality with reported conductivity and pH values in the range 92 to 690 μS/cm and 6.8 to 7.8 respectively (Stratford EIS). Monitoring in Avondale River has continued through until present with water quality results consistent with those obtained prior to the Stratford EIS publication.

Monitoring of water quality in Avondale Creek upstream and downstream of the mine both before commencement of mining and over the period that mining activities have been carried out has shown that the creek is typically brackish during normal low flow periods and freshens up during periods of pronounced runoff. Baseline data given in the Stratford EIS indicate conductivity levels have exceeded 7,000 μS/cm (ranging down to 520) in Avondale Swamp downstream of the mine. Current results show a range of 10,290 μS/cm down to 150 μS/cm for the same sampling location.

Baseline monitoring undertaken for the Stratford EIS in Dog Trap Creek, below the mine site, showed conductivity results up to 1,000 μS/cm. Monitoring since the completion of the EIS has returned conductivity results in the range 110 μS/cm to 960 μS/cm.

2.2 GROUNDWATER

The following baseline hydrological considerations are relevant to life of mine rejects planning:

- The local groundwaters are moderately to highly saline (1,500 to 9,000 μS/cm) with predominantly sodium chloride salts.
- Groundwater pH has varied from slightly acidic (pH 5.6) to slightly alkaline (pH 8.4).
- Groundwater is used in Stratford for domestic purposes although it is generally unsuitable for drinking purposes.
- The dominant flow direction will be from the Stratford township area toward the mine although the rates of groundwater flows are small and mining activities have not had a measurable affect on the groundwater levels in bores in Stratford township to date.
- Avondale Creek is typically brackish particularly during dry periods when it tends to reflect the groundwater baseflow. Water quality improves markedly during runoff periods. Surface waters are used for stock water.
- Rejects water is typically less saline than the local groundwaters with the dominant salts being sodium, chloride and sulphate.

3 GEOLOGY AND COAL RESOURCES

3.1 REGIONAL GEOLOGY

The Stratford coal resources form part of the Gloucester Basin and lie within a north-south trending synclinal structure approximately 40 km long by 13 km wide. The basin is of Permian age and contains conglomerate, sandstone, siltstone, mudstone and coal. The coal measures occupy the valley floor while the hills on either side are composed of folded acid volcanics of Carboniferous age.

3.2 GEOLOGY OF THE PROJECT AREA

3.2.1 Stratford Main Deposit

The Project area lies within the central eastern flank of the Gloucester Basin. The main deposit forms a syncline plunging gently to the north with coal outcropping at steep dips on the eastern and western limbs and the southern end. Normal faulting occurs in the main deposit but is minor (with the exception of one 50 m throw fault) and no intrusives occur in the main deposit.

The main deposit is classified as medium-high volatile bituminous coal displaying excellent coking properties. It is of superior grade to the majority of other coals being shipped from Newcastle.

3.2.2 Roseville Deposit

A small reserve of Roseville seam coal, approximately 500,000 t, occurs within the existing development area adjacent to the rejects co-disposal dam. Mining of this deposit will provide a source of high quality, low dilution raw coal for blending with CPP feed coal from the Stratford main deposit and will permit secure disposal of Duralie rejects.

4 PROJECT DESCRIPTION

4.1 DESCRIPTION OF THE EXISTING OPERATION

The Stratford Coal Project comprises an area of some 1,500 ha covered by Mining Leases (ML) ML 1409, ML 1360 and Mining Lease Application (MLA) MLA 94. All land within the Project area is owned freehold by the SCPL.

The Stratford Coal Project comprises an open-cut mine based on the Stratford Main Deposit and Roseville Deposit with a coal preparation plant (CPP) and associated raw and product coal handling and rail loading facilities. The Stratford Project currently involves mining a reserve of 23.5 million tonnes (Mt) at a planned mining rate of 3.4 million tonnes per annum (Mtpa) of ROM coal resulting in 1.7 Mtpa of product coal over some 8 years of operating life.

Mining equipment is organised into two fleets, one working on overburden and the other predominantly mining coal and providing supplementary overburden mining capability on night shift. Operations are conducted over 24 hours per day, 6 days per week.

Coal is processed in a 400 tph coal preparation plant (CPP) with coarse coal (ie. 50 mm to 1 mm) treated using dense medium cyclones and fine coal (ie. 1 mm to 0.125 mm) treated using spirals. The CPP operates on a three shift, 6 days per week basis. Feed to the CPP is by front-end loader based on blending from the ROM stockpile.

All coal is transported from the mine site by rail by the Freight Rail division of SRA. Trains load in approximately one hour and haul the coal to the Port of Newcastle and the BHP steelworks at Newcastle.

4.2 DESCRIPTION OF THE PROPOSED MODIFICATIONS

This section describes the proposed modifications to the Stratford Coal Project. In essence the modifications entail little change to the layout and total area of disturbance. Table 4-1 provides a summary of the current Project and proposed modifications. The key modifications to the existing Stratford operation are:

- construction of additional infrastructure;
- a reduction in the Stratford mining rate;
- importation of ROM coal from Duralie;
- disposal of Duralie rejects at Stratford.

Table 4-1
Stratford Coal Project
Comparison of Current and Proposed Modified Project

PROJECT FEATURE	CURRENT PROJECT	PROPOSED MODIFIED PROJECT
Resource	• Total coal resource of 32.5Mt. • Coal mined (reserve) 23.5Mt.	• As per current project with an additional 8.9Mt of reserve from Duralie Coal Mine to be processed through Stratford Coal Preparation Plant (CPP).
Production	• Mining of up to 3.4Mtpa of ROM coal. • ROM coal processed through CPP to produce up to 1.7Mtpa of product coal.	• Greater than 35% reduction in current mining rate of Stratford ROM coal to 2.1Mtpa to accommodate inclusion of Duralie ROM coal into the Stratford processing system. • 1.3Mtpa of ROM coal to be imported from the Duralie Coal Mine. • ROM coal processed through CPP to produce up to 1.7Mtpa of product coal, as per current project.
Total Area of Disturbance	Disturbed areas within the project area are in the form of pit/dump areas, rejects disposal area, dams and water diversions, access roads, rail loop and Coal Preparation Plant (CPP).	Similar layout to that of the current project, with the following additions: • Train unloading hopper and associated conveyor. • 10,000-15,000 tonnes ROM coal stockpile and 30,000 tonnes product coal stockpile. • Reclaim hopper and associated conveyor.
Workforce	Operational workforce of 150 people.	Operational workforce of approximately 110 people.
Operating Hours	Mine and CPP operated 24 hours per day, 6 days per week.	As per current project.
Mine Life	8 year operation stage.	• 11 year operation stage. • Duralie Coal to contribute ROM coal to Stratford process for 8 years.
Water Management	Extensive clean water diversion and dirty water collection system.	Water management systems essentially the same but will include measures to achieve the objectives set out in the Duralie EIS for containment of Duralie Coal rejects.
Waste Management	• Total overburden quantity of 67Mbcm • 8.6Mt of CPP rejects disposed of in waste emplacements and/or within deep sections of the pit, using the co-disposal technique.	As per current project with additional rejects generated from processing of Duralie ROM coal to be contained as above.
Infrastructure	ROM coal processed through dedicated CPP and stored in product coal stockpile prior to being railed off-site for export.	Project infrastructure as per current project with the following additions: • Train unloading hopper and associated conveyor. • 10,000 to 15,000 tonnes ROM coal stockpile. • Reclaim hopper and associated conveyor. • Extension of product stockpile. • Construction of an acoustic/visual barrier.
Coal Transportation	Product coal transported to the Port of Newcastle on 3,150t capacity trains, with up to 540 train movements per annum. Up to 4 trains may travel from the site in any 24 hour period.	• Duralie ROM coal to be transported to Stratford Coal Mine on 1,600t capacity trains, with up to 750 trains per annum. Up to 3 trains may travel to site from Duralie in any 24 hour period. • Duralie ROM coal to be campaign processed at Stratford in place of Stratford ROM coal. Product coal then exported from site to Newcastle with up to 540 train movements per annum, as per current project.
Mine Fleet	Approximately 30 Items	Mine fleet reduced by approximately 35%.

Source: CIM Resources

Importation of ROM Coal from Duralie and Product Stockpile Extension

A 1,500 t/hr rail unloading facility would be established on the existing balloon loop and a small extension to the product coal stockpile would be constructed as shown in Figure 4-1 and summarised in Table 4-2 below.

Table 4-2
Proposed 1,500 t/hr Rail Unloading Facility
and Product Coal Stockpile Extension

Item	Description
Rail Unloading Bin	Enclosed 1,600 t, bottom dump hopper
ROM Conveyor 1	200 m ROM coal conveyor
Conical Stockpile	15,000 t capacity, 22 m high
Radial Stockpile	12,000 t capacity, 9 m high
CAT D10 Dozer	Dozer tracking, feeding dump hopper
ROM Conveyor 2	180 m ROM coal conveyor
Product Conveyor 1 and Drive	36 m Product Conveyor 1 extension

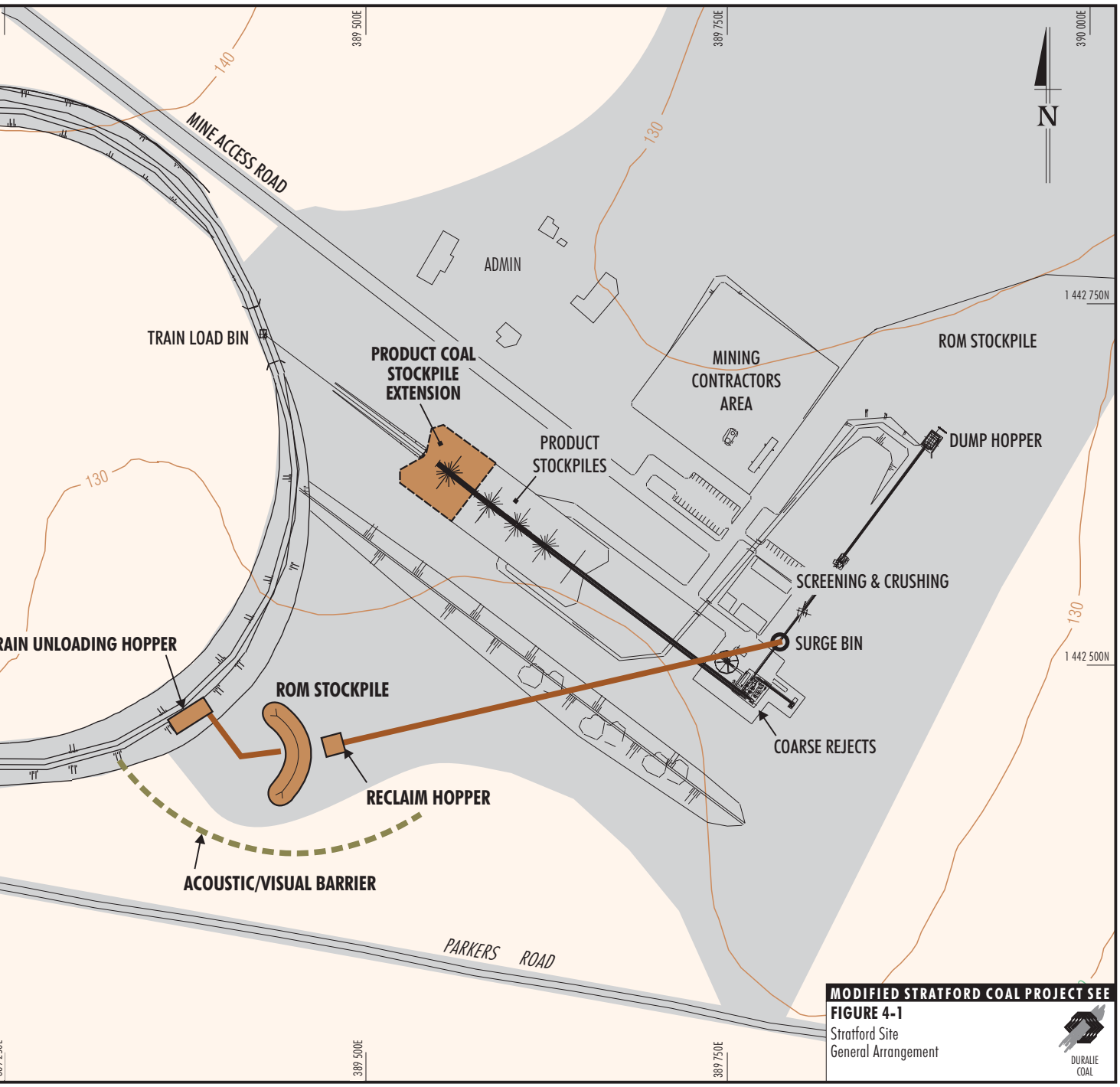
Reduction in Mining Rate

Duralie ROM coal will be used to replace Stratford ROM coal as feed to the CPP. As a result the current mining rate of Stratford ROM coal will reduce.

Rejects Disposal

Gilbert & Sutherland (1998) have undertaken a detailed assessment of the proposal to dispose of Duralie rejects at Stratford. A summary of their assessment is provided below with the full report appearing as Appendix A of this report.

The proposed rejects disposal strategy involves the disposal of less reactive Stratford rejects in existing above ground disposal areas and the final permanent disposal of Duralie rejects below the water table in the Roseville pit and Stratford final void.


389 500E
389 750E
390 000E
140
130
MINE ACCESS ROAD
ADMIN
N
1 442 750N
TRAIN LOAD BIN
PRODUCT COAL
STOCKPILE
EXTENSION
PRODUCT
STOCKPILES
MINING
CONTRACTORS
AREA
ROM STOCKPILE
DUMP HOPPER
SCREENING & CRUSHING
SURGE BIN
RAIN UNLOADING HOPPER
ROM STOCKPILE
1 442 500N
COARSE REJECTS
RECLAIM HOPPER
ACOUSTIC/VISUAL BARRIER
PARKERS ROAD
MODIFIED STRATFORD COAL PROJECT SEE
FIGURE 4-1
Stratford Site
General Arrangement
DURALIE
COAL

The disposal of Duralie rejects at Stratford is proposed as follows:

- Bath rejects would be deposited (dry) in the Stratford pit and, if necessary, treated with lime.
- Washery rejects would be deposited:
  - initially into a temporary above ground storage cell (with subsequent removal to the Roseville pit when mining of Roseville is complete);
  - subsequently into the mined out Roseville pit; and
  - finally into the Stratford final void (once mining operations cease in the Stratford pit).

Duralie washery rejects would be deposited sub-aqueously in all three locations to minimise oxidisation.

5 IMPACT OF THE PROJECT ON THE ENVIRONMENT AND PROPOSED CONTROL MEASURES

The key environmental implications identified with respect to the proposed modifications to the Stratford operation are as follows:

- Reduced potential noise, air quality and blast impacts due to a 35% reduction in mining rate
- Increased rail traffic associated with the railing of ROM coal from Duralie
- Associated potential increase in rail traffic-related noise impacts
- Disposal techniques for Duralie coal rejects at Stratford need to be designed to achieve those objectives proposed and approved for the Duralie Project

Potential impacts on topography, landuse, visual features, flora and fauna, archaeology and socio-economics associated with the proposed modifications to the Stratford Project are similar to those outlined in the Stratford EIS. Mitigation measures detailed in the EIS and implemented to date are considered adequate to cover the proposed modifications.

The abovementioned modifications will, however, result in potential impacts with respect to site hydrology, acoustics, air quality and transport. Details of these potential impacts and, where necessary, proposed mitigation measures are outlined below.

5.1 HYDROLOGY

Gilbert and Sutherland Pty Ltd (G&S) were commissioned to assess the implications of Duralie rejects disposal at Stratford (Appendix A). Appendix A presents a plan for the secure disposal of Duralie coal rejects at the Stratford site consistent with the objectives of the rejects disposal strategy approved for the Duralie Project. All Duralie rejects are proposed to be permanently stored below the water table such that oxidation should be effectively prevented and risks to surface and groundwater resources should not be an issue of concern.

The G&S study also found that mixing of reject waters with groundwaters surrounding the Roseville pit will occur in a limited localised area around the pit. The regional groundwater flow will however be toward the pit and this trend will not be affected by mining or backfilling operations. Furthermore, the quality of waters in the groundwater system surrounding the Roseville pit is such that any seepage of reject waters would not, in any case, compromise current beneficial usage.

Furthermore, no additional or new areas are required for disposal of rejects from Duralie. Rehabilitation of Duralie rejects disposal areas is therefore consistent with the current plan for rejects disposal at Stratford.

5.2 ACOUSTICS

To assess the potential increase in rail traffic-related noise impacts Richard Heggie Associates were commissioned to undertake the study - *Stratford Coal Mine Train Unloading Operations – Preliminary Noise Impact Assessment, 1998* (Appendix B). This study assesses current Stratford operating noise emissions and compares this with those predicted for the modified project. The study focuses on the areas of rail unloading, overall mine operation and rail transportation.

Potential Impacts

Existing rail loading and proposed rail unloading operations cannot occur simultaneously, therefore it is not necessary to consider cumulative noise impacts. However, train operation (ie. rail loading or rail unloading) will occur at twice the current frequency with up to eight train movements per day.

The total overall sound power level of the existing rail loading facility is 121 dBA, similarly the total overall sound power level of the proposed rail unloading facility is 121 dBA.

It is reasonable to assume that noise emissions from the proposed rail unloading facility (radial stockpile) would be equivalent or only marginally less than the existing rail loading facility as the dozer would operate (as required) on the radial stockpile (maximum 9 m) which is well below the elevation of the product stockpile (maximum 20 m).

Existing train loading noise emissions (ie. train loading, wagon and locomotive noise) at BG4 Bagnall and BG4A Bramley (refer Appendix B) are clearly discernible from other mine generated noise emissions, where the maximum recorded $L_{A10(15\ minute)}$ noise level is 45 dBA.

In view of the proposed doubling in train operations (ie. train loading or train unloading) then noise emissions in order of 40 dBA to 45 dBA are likely to occur at approximately twice the current frequency at BG4 Bagnall and BG4A Bramley (refer Appendix B).

The total overall sound power level of the existing mining operation (including rail loading) is 136 dBA.

Mitigation Measures

It is concluded that overall magnitude mine noise emission levels will remain unchanged as a result of the proposed operating variations.

It is concluded that the average traffic and peak traffic $L_{Aeq(24\ hour)}$ noise emissions arising from the predicted total train movements (ie. existing and proposed Duralie movements) comply with the EPA's recommended 60 dBA $L_{Aeq(24\ hour)}$ noise criterion at a distance of 25 m. In addition, the predicted maximum ($L_{Amax)}$ noise emission from the proposed Duralie train movements complies with the EPA's 85 dBA criterion.

Furthermore, noise emissions from the additional train movements would increase existing train noise levels in the vicinity of the railway only marginally (1 dBA) producing a negligible impact on existing receivers.

The acoustic/visual barrier will also provide appreciable noise attenuation to the ROM coal conveyors and the reclaim hopper and to a lesser extent, the radial stockpile dozer.

5.3 AIR QUALITY

Potential air quality impacts associated with proposed Project modifications are as follows:

- Reduced ROM coal production at Stratford (approximately 35%) should result in decreased dust emissions from mining operations including blasting.
- The Duralie ROM coal stockpile and proposed extension to the product coal stockpile present a potential additional source of dust. Both stockpiles will, however, be captured by expansion of current dust suppression and other existing mitigation measures. As a result, no significant increase in dust emissions from these stockpile areas is expected.

5.4 TRANSPORT

The decreased production of ROM coal at Stratford will result in a slight reduction in workforce (150 to 110), marginally reducing workforce movements to and from the mine.

6 REHABILITATION

Rehabilitation works will be closely integrated with mine production and will be undertaken progressively as mining proceeds. Disturbed land will be returned to a stable condition and to a land capability at least equal to that which existed prior to mining. Revegetation will result in the establishment of legumes and endemic grasses with extensive tree covered areas. The rehabilitation programme is described in detail in Section 4.10 of the Stratford EIS. Rehabilitation performance to date is documented in the 1998 AEMR.

The primary objectives of the rehabilitation programme are the minimisation of erosion and reinstatement of pre-mining land capability. The secondary objectives of rehabilitation are:

- the generation of a final rehabilitated landform which is consistent with general landforms in the area and which will blend in with the hills to the east;
- to provide a landform which is suitable for the primary final land uses of grazing, forestry and faunal habitat enhancement;
- to plan mining and overburden handling operations to minimise rehandling, reshaping and contouring;
- to minimise the amount of disturbed land awaiting rehabilitation; and
- to provide for the safe and environmentally acceptable disposal of CPP rejects.

As the proposed modifications at Stratford will include the incorporation of rejects from Duralie coal processing, the rejects disposal regime will be refined to reflect this. However, rehabilitation proposals (as discussed in Appendix A) remain consistent with those objectives outlined above.

7 ENVIRONMENTAL MANAGEMENT AND MONITORING PROGRAMME

A comprehensive environmental management and monitoring programme is in operation at Stratford and will continue for the duration of the Project. This programme was commenced in 1993/1994 with respect to air quality, surface water and groundwater resources and was developed in consultation with relevant authorities during the Project construction phase.

The monitoring and management programmes for the project are detailed in Section 4.11 of the Stratford EIS and the Annual Environmental Management Report (AEMR) (June 1998). The elements of the monitoring and management system are listed below.

Meteorological Monitoring

- Rainfall;
- Evaporation;
- Wind speed and direction;
- Temperature.

Air

- Dust monitoring, both static and high volume;
- Dust control procedures.

Vibration and Airblast

- Control procedures;
- Monitoring airblast overpressure;
- Monitoring ground vibration.

Coal Washery Rejects/Reject Management

- Handling and disposal procedures;
- Characterisation of residues;
- Disposal area rehabilitation monitoring;
- Monitoring and maintenance of disposal facilities.

Other Waste Management and Recycling

- Sewerage treatment and disposal;
- Fuel containment;
- Oil and grease containment and disposal;
- Rubbish disposal.

Hazardous and Explosives Material Management

7.1 WATER MANAGEMENT

The prioritised system of water usage has been outlined in Section 4.9 and Appendix 3 of the Stratford EIS. Details of the surface water and groundwater monitoring programme are set out in Appendix 3 of the EIS.

The principles of the water management system are:

- to divert clean water around disturbed areas;
- to capture and store water falling on disturbed areas in the dirty water system;
- to have nil discharge of mine water;
- to utilise dirty water first; and
- to discharge off site no sediment laden water having a suspended solids concentration in excess of 50 mg/L.

The water monitoring system is designed to provide feedback on the effectiveness of the surface water and groundwater management and the sediment control systems on site. These systems are designed to assist in the management of:

- clean water;
- dirty water;
- overburden dump water runoff;
- haul road runoff;
- groundwater; and
- sediment and erosion control.

Water management requirements proposed for the Duralie rejects disposal are outlined in Appendix A along with a discussion on existing system performance.

Following subaqueous deposition of Duralie washery rejects, return water from the Roseville pit or the Stratford final void will be pumped to the return dam for use in the CPP. Management of Duralie Coal rejects will include maintenance of a water cover over the reject material. A low point would be formed by moving the rejects discharge point to allow for the formation of a comparatively deep pond within the pit for utilisation as a decant pond. A pump on a floating pontoon would be located within the pond, and return water and runoff transferred to the return dam. Pumping capacity would be required to be (as a minimum) equivalent to the plant demand (7.30 ML/day or 85 L/s) so as to ensure maintenance of reliability of supply and maximise recovery. The pumping system would also be required to be reversible for potential transfer of water to Roseville pit or the Stratford final void during extended dry periods, so as to maintain the required minimum cover of water over the reject material. Further details may be found in Appendix A.

7.2 NOISE

The Stratford mine has an existing noise emissions monitoring and management system comprising noise monitoring at a series of locations, noise control measures and a Noise Management Plan. A brief description of these components is given below.

Noise Monitoring

SCPL is required to undertake quarterly noise monitoring surveys in accordance with development consent conditions. This monitoring entails measuring the LA_{10} 15 minute noise level over a minimum 72 hour period, at locations specified by the EPA. Locations specified by the EPA may change over time due to changes in land tenure or Project modifications. The present monitoring locations and the results of the monitoring programme as compared to the permitted noise levels can be found in the AEMR.

Noise Management Plan

The Noise Management Plan enables the development of noise control measures to be proposed and implemented where exceedance of approved levels has occurred, or complaints have been received.

Noise Control Measures

Noise control measures have been undertaken to alleviate problems identified through noise monitoring in accordance with the Noise Management Plan. These actions have in the past included such things as reducing alarm volumes on site, alterations to dumping and truck movements, construction of sound barriers and alterations to train loading schedules etc.

Due to the potential impact of the proposed Project modifications at Stratford, a preliminary noise impact assessment was commissioned to assess the current noise levels and the likely potential impacts of the modifications on noise. The results of this assessment can be found in Appendix B and in the impacts section of this document (Section 5). This assessment will be utilised to further refine noise monitoring procedures and will be incorporated into a revision of the Noise Management Plan.

8 REFERENCES

Gilbert & Sutherland Pty Ltd (1998) *Stratford Coal Project – Amended Rejects Disposal Plan (Incorporating Duralie Rejects)*. Prepared for Stratford Coal Pty Ltd.

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Richard Heggie Associates Pty Ltd (1998) *Stratford Coal Mine Train Unloading Operations – Preliminary Noise Impact Assessment*. Prepared for Stratford Coal Pty Ltd.

Stratford Coal Pty Ltd (1994) *Stratford Coal Project Environmental Impact Statement*. Prepared by AGC Woodward-Clyde Pty Ltd.

Stratford Coal Pty Ltd (1998) *Annual Environmental Management Report*. Stratford Coal Pty Ltd.

APPENDIX A

REPORT FROM GILBERT & SUTHERLAND PTY LTD
STRATFORD COAL PROJECT
AMENDED REJECTS DISPOSAL PLAN
(Incorporating Duralie Rejects)

GILBERT AND SUTHERLAND PTY LTD
Soil and Water Resource Consultants

REPORT

STRATFORD COAL PROJECT

Amended Rejects Disposal Plan
(Incorporating Duralie Rejects)

Prepared for: CIM Resources Pty Ltd.

Aug 1998
bj9701-3.rd1.doc

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APPENDICES

1.0 INTRODUCTION

Stratford Coal Pty Ltd (SCPL) propose to apply to the NSW Department of Mineral Resources (DMR) for approval of an amended rejects disposal plan to cover the processing of coal from the Duralie mine at the Stratford washery. The initial rejects disposal plan for Stratford was outlined in the Environmental Impact Statement (EIS) and involved disposal to the purpose built western rejects emplacement area, followed by disposal to the Roseville and Bowen's Road Pits (after cessation of mining in these satellite deposits), and finally disposal to a purpose created cell within the main out of pit mine waste dump.

Experience with processing Stratford coal has shown that coal recovery is lower than was originally predicted, resulting in a higher rate of reject production. The rate of coal processing has also increased from 1.4 to 1.8 million tonnes per year. The combined effect of the lower coal recoveries and higher coal mining rate meant that the approved rejects disposal plan was inadequate and that an amended plan covering the remainder of the mine life was required.

Further amendments are now also required to cover processing (washing) of coal from Duralie at Stratford. The proposal to wash Duralie coal at Stratford involves transporting run-of-mine coal from Duralie to Stratford by rail for washing. The coal from Duralie would be washed separately (in campaigns) to produce separate product coal and reject streams. The product coal would be freighted out by rail for export through the Port of Newcastle and the rejects would be disposed of on the Stratford mine lease area.

Processing of coal from the Stratford Mine would be completed in late 2004 while Duralie coal would be processed at Stratford for a further 2 years (ie until 2006).

This amended reject plan covers the handling and disposal of the projected reject production from both Stratford and Duralie coals over the remaining life of the project (2006). It draws on the results of earlier investigations and studies undertaken for both the Duralie and Stratford projects.

2.0 REJECTS DISPOSAL OBJECTIVES

The requirements and objectives for rejects disposal at the Stratford site are:

1. Capacity to store the projected quantity of rejects to be produced over the remaining life of the project.

   The estimated reject disposal requirements are:

   Stratford Coal
   2.9 million tonnes of Bath Rejects
   5.2 million tonnes of Washery Rejects
   Duralie Coal
   1.0 million tonnes of Bath Rejects
   3.6 million tonnes of Washery Rejects

2. Development of reject emplacement landforms, which are safe, stable and which are consistent with the post mining land use objectives.

   Generalised final land use objectives for reject disposal landforms comprise light grazing on the flatter plateau areas with other areas developed as tree lots for wildlife corridors and refuges. (Refer Stratford EIS, Woodward–Clyde, 1994)

3. Control over water movement to and from reject disposal areas such that there is a low risk of surface and groundwater contamination either during the active mine life or post rehabilitation and lease relinquishment.

4. Low development, operational and closure (rehabilitation) costs.

   This objective can be achieved by minimising further disturbance optimising the use of existing rejects disposal areas and by backfilling mine voids.

5. Compatibility with possible future mine development opportunities at Stratford

   This objective can be met by providing flexibility to either expand or contract reject storage requirements within the confines of the planned disposal areas.

6. Compliance with the regulatory guidelines/requirements.

3.0 REJECTS CHARACTERISTICS

3.1 Physical Characteristics

There are two waste streams produced from the Stratford washery.

- Bath rejects that are scalped off the washery feed and removed from the washery by truck. These comprise coarse oversized rock fragments.

- Washery rejects comprise 30% slimes and 70% intermediate sized coarse waste materials that have been washed from the product coal. The washery rejects are combined and pumped as slurry to the disposal storage.

Physical properties of these waste materials (as generated from washing of run-of-mine coal from the main Stratford pit) have been measured in recent laboratory testing and are summarised in Table 1 below. Details of the testing and results are given in Appendix B.

Table 1
Physical Testing of Stratford Rejects

Material Type	Physical Property	Measured Value	Comment
Washery Reject (Beach Deposit)	Settled Dry Density	1.24 ($t/m^{3)}$	Average of 3 insitu tests
	Moisture Content	11.8 (%)	Average of 3 tests
	Specific Gravity	1.67	Average of 3 tests
	Particle Size	10% less than 0.3mm 50% less than 6mm 90% less than 30mm	Approximate average of 3 tests
	Saturated Hydraulic Conductivity	6×10^{-6} m/s	Single constant head test under negligible vertical stress
Washery Reject (Slimes Fraction)	Moisture Content	71.6 (%)	Single test
	Specific Gravity	2.06	
	Particle Size	100% passing 0.425mm 96% passing 0.075mm	Single test
	Saturated Hydraulic Conductivity	$2.5X10^{-8}$ (m/s)	Single Rowe cell test under 10kPa vertical stress

It is expected that an additional 2.9 million tonnes of bath and 5.2 million tonnes of washery rejects will be produced from processing of the remaining reserves of Stratford coal.

Mining and processing of Duralie coal would involve an additional 4.6 million tonnes of rejects comprising some 25% bath reject and 75% washery reject.

The physical characteristics of the Duralie rejects are expected to be similar to the Stratford reject streams. The storage requirements of these waste streams are summarised in Table 2.

Table 2
Rejects Production and Disposal Requirements

Stratford		
Waste Stream	**Anticipated Production (million tonnes)**	**Storage Volume Requirements (ML)**
Bath Rejects	2.9	1,700
Washery Rejects (Total)	5.2	4,800
Slimes Fraction	1.6	
Coarse Fraction	3.6	
Duralie		
Waste Stream	**Anticipated Production (million tonnes)**	**Storage Volume Requirements (ML)**
Bath Rejects	1	600
Washery Rejects (Total)	3.6	3300

3.2 Chemical Characteristics of Process/Reject Waters.

The chemistry of rejects water is dominated by the chemistry of the source of process water. Process water is a combination of the water recovered from pit dewatering, make-up from local bores, and water recovered from the rejects disposal area. Results of monitoring by SCPL indicate that slurry water is moderately saline, with TDS levels ranging between 3,000 and 4,000 mg/L. The major constituents comprise chloride and sulphate salts. The water is also typically near neutral to slightly alkaline due to the use of lime as a reagent in the washery to control acid generation in the product coal.

Based on the results of testing of Duralie waste (reject) materials, water recovered from the Duralie reject areas may have higher sulphate concentrations than waters recovered from Stratford reject disposal areas. It is possible therefore that processing of Duralie coal at Stratford will lead to increased sulphate salinity in the process water dam. The increases are however likely to be small if the rejects are maintained in a fully saturated condition as is proposed under this plan.

3.3 Geochemical Characteristics

3.3.1 Stratford Rejects

The geochemical characteristics of the Stratford rejects have been investigated by Environmental Geochemistry International (EGi). EGI's conclusions relevant to the management of Stratford rejects are:

- Both the bath and washery rejects contain significant reactive sulphides and acid neutralising carbonates. These materials will be reactive when exposed to surficial oxidation processes.
- Both bath reject and the slimes fraction of the washery reject are likely to contain sufficient available carbonates to neutralise acid generated through sulphide oxidation and therefore these materials are not likely to develop acid conditions.
- Due to the higher reactive sulphide content and lack of available carbonates in the washery beach deposits, it is likely that acid conditions will develop in these materials when left exposed. Reaction kinetics indicates that acid conditions are likely to develop in 3 to 6 months following exposure.
- There were no elements present in the rejects in sufficiently high concentrations to warrant further geochemical investigation.

Copies of EGi's Interim Reports and Stage 2 Report are included as Appendix A

3.3.2 Duralie Rejects

The geochemical characteristics of rejects from Duralie Coal were also assessed by EGI. Results of these investigations are summarised in the Duralie project EIS (Refer Woodward-Clyde, September 1996). The key conclusions are:

- The rejects will have relatively high total sulphur content and low to negligible acid neutralising capacity. As a consequence EGI have classified these materials as potentially acid forming with high capacity to generate acid.
- Column test results indicate that if left untreated and exposed to air and moisture, Duralie rejects will generate acid and high sulphate sulphur concentrations in leachate and runoff water.
- This is also likely to occur relatively soon after exposure.
- Testing with different lime dosing rates indicated that effective pH and sulphate control could be achieved with dosing rates in the range 5 to 10kg/tonne range.
- Sulphate generation rates were found to be highly sensitive to pH (increasing as pH values fell). At pH values above about 4, sulphate generation is controlled by solubility.
- If left untreated and exposed to air the rejects produced from washing of the Duralie coal are likely to be significantly more reactive than Stratford rejects.

3.4 Rejects Placement and Handling Requirements

3.4.1 Stratford Rejects

Results from geochemical testwork undertaken by EGi have indicated that acid conditions are likely to develop within the washery reject beach material within 3 to 6 months of exposure to

atmospheric conditions. Site experience to date has been that no significant acid generation from the exposed beach material has occurred.

Liming of water within the plant is undertaken as part of the process, and this would have positive effects on sulphate and/or acid generation within the washery rejects. The addition of lime within the process is likely to have positive effects on leachate quality of a similar nature to those indicated for the limestone treated beach rejects within the EGi testwork (ie: reduced sulphate release and pH control over a period dependent upon the rate of treatment). For rejects placed with some form of lime treatment (either by direct treatment of rejects as undertaken within the testwork, or liming of process water), acid conditions would be expected to develop after a longer lag period than for rejects placed without the addition of lime.

In addition to liming, rejects placed in active cells of the western reject disposal area are being continually covered by fresh reject discharge, limiting the exposure of the rejects. The rejects area is maintained in a generally saturated state due to continuous return of process water, further limiting the exposure of placed rejects to atmospheric conditions.

In light of the potential for acid generation identified in the EGi report, it is proposed that completed cells of the rejects area be covered progressively and that close monitoring be undertaken of reject area runoff and seepage be undertaken.

3.4.2 Duralie Rejects

There is a significantly higher acid generation potential associated with Duralie rejects than for rejects produced from Stratford coal. This will require different handling and separate disposal.

General recommendations for management of Duralie Coal rejects as determined from the results of geochemical characterisation testwork are:

- All potentially acid forming materials placed in-pit should be located at an RL that is below the projected post-mining groundwater table. PAF material located below the permanent water table will exclude oxygen from the contained sulphides and is the most secure long-term control strategy.

- Crushed limestone may need to be mixed with bath rejects prior to disposal. Trials will need to be conducted at commencement of operations to determine what lime addition rates (if any) are required to control acid generation in the short term (prior to permanent emersion below water). Testwork on 'total' reject samples has shown that liming rates of 5 to 20kg $CaCO_3$/t may be required.

In general, the key features of reject handling and disposal adopted in the Duralie project EIS were addition of crushed limestone (1mm size) at 10 to 20 kg/tonne to provide short term control over acid and sulphate generation (for up to 24 weeks) and permanent isolation from atmospheric oxygen for long term control of acid generation potential.

The method proposed for disposal of Duralie reject in this plan involves sub-aqueous disposal in the Roseville and main Stratford open cut. This would negate the need for special lime treatment as it provides for immediate and permanent isolation from atmospheric oxygen.

The bath reject would be placed (semi-dry) in the lower levels of the main Stratford pit until completion of mining. Post mining, bath rejects from Duralie coal would then be placed sub aqueously in the main Stratford void. During the dry disposal phase lime dosing if required, would be carried out at rates determined by trials (as discussed above).

4.0 SITE HYDROLOGICAL CHARACTERISTICS

Stratford Coal Mine is located in the Gloucester Valley and is drained by a number of small tributary creeks of the Avon River. The Avon itself is a tributary of the Manning River, which discharges to the Pacific Ocean at Taree. The mine is located on gently sloping valley floor terrain abutting a steep range of hills to the east. Avondale Creek (the main local drainage feature) traverses the site on the western side of the main pit. Avondale Creek is ephemeral although it has strong recessionary flow persistence suggestive of significant groundwater baseflow.

Surface water quality monitoring data for the Avon River indicates generally good water quality with reported conductivity and pH values in the range 92 to 690 µS/cm and 6.8 to 7.8 respectively (Stratford EIS). Monitoring in the Avon River has continued through until present with water quality results consistent with those obtained prior to the Stratford EIS publication.

Monitoring of water quality in Avondale Creek upstream and downstream of the mine both before commencement of mining and over the period that mining activities have been carried out has shown that the creek is typically brackish during normal low flow periods and freshens up during periods of pronounced run off. Baseline data given in the Stratford EIS indicate conductivity levels have exceeded 7,000 µS/cm (ranging down to 520) in Avondale Swamp downstream of the mine. Current results show a range of 10,290 µS/cm down to 150 µS/cm for the same sampling location.

Baseline monitoring undertaken for the Stratford EIS in Dog Trap Creek, below the mine site, showed conductivity results up to 1000 µS/cm. Monitoring since the completion of the EIS has returned conductivity results in the range 110 µS/cm to 960 µS/cm.

The mine area is underlain by Quaternary colluvium, which is in turn underlain by the Avon Coal Measures (Stratford EIS). Borehole water level data indicate that the original groundwater flow was from the southwest to the northwest. Groundwater intersects the surface in the northern and western areas of the basin. The coal seams form the major aquifer with relatively smaller flows being evident in the overburden. The overburden was found to have generally low permeability although some higher permeability zones associated with fracturing were found. The requirements for mine dewatering have been significantly less than original predictions. The drawdowns induced in bores around the mine have also been small indicating that there is relatively little water movement in the local groundwater system.

Groundwaters were found to be moderately saline (with conductivities ranging from 1,500 to 9,000 µS/cm). The dominant ions were sodium and chloride. Groundwater is used in the Stratford Township for garden irrigation and domestic washing. Salinity levels in bores in the Stratford Township have varied from 420 to 8,300 µS/cm. pH values have varied from 5.8 to 7.5. The chloride content of the groundwater ranged from 16 to 3,246mg/L

The conductivity in individual bores has not changed markedly over the monitoring period and the large variability between bores is thought to reflect different groundwater sources. The higher conductivity bores are generally

those that tap the deeper more saline groundwater associated with the coal measures, while the fresher water appears to be associated with localised shallow groundwater zones. The salinity of the groundwater ranges from medium, (where care should be taken when growing salt sensitive crops) to very high (where water is not suitable for irrigation under ordinary conditions). In general the salinity of the existing groundwater is higher than that present in the reject water.

In summary, the following baseline hydrological considerations are relevant to life of mine rejects planning:

1. The local groundwaters are moderately to highly saline (1,500 to 9,000µS/cm) with predominantly sodium chloride salts.
2. Groundwater pH has varied from slightly acidic (pH 5.6) to slightly alkaline (pH 8.4).
3. Groundwater is used in Stratford for domestic purposes although it is generally unsuitable for drinking purposes.
4. The dominant flow direction will be from the Stratford Township area toward the mine although the rates of groundwater flows are small and mining activities have not had a measurable affect on the groundwater levels in bores in Stratford Township to date.
5. Avondale Creek is typically brackish particularly during dry periods when it tends to reflect the groundwater baseflow. Water quality improves markedly during runoff periods. Surface waters are used for stock water.
6. Rejects water is typically less saline than the local groundwaters with the dominant salts being sodium, chloride and sulphate.

5.0 REJECTS DISPOSAL PLAN

5.1 Strategy

The proposed rejects disposal strategy involves disposal of the less reactive Stratford washery rejects within above ground rejects disposal areas. Disposal of the more reactive Duralie washery rejects would comprise final placement within mined out pit areas (Roseville and Main Pits) to levels beneath the expected long-term water table. Bath rejects from the Stratford Project would be backloaded into the main pit, with bath rejects from Duralie Coal placed dry in the lower levels of the main pit and, if necessary, treated with lime in accordance with the approved Duralie rejects disposal plan. Both these materials would be placed below the final water level in the main Stratford pit.
The potential rejects disposal areas suitable for rejects disposal at Stratford comprise:

1. Western rejects co-disposal area.

   This would incorporate expansion of the original disposal limits northward toward the southern Roseville pit limits. The expanded disposal area would be limited in area and height to blend in with the surrounding topography and the long term surface drainage requirements (Refer Figure 1). This area would have sufficient capacity to store some 3,500ML of rejects.

2. Eastern overburden area.

   This option would involve utilising the void left in the main overburden emplacement area south of the main pit. This area would have capacity for disposal of some 8,500 ML of rejects. (Refer Figure 1).

   Migration of water from the rejects back through the overburden dump would need to be controlled and it is proposed that a low permeability (compacted) earthfill embankment/membrane be constructed around the base of the disposal area as part of the storage preparation works. As the reject beach is built up, a larger proportion of the liberated water would report to the toe of the beach. The resulting decant pond would then progressively retreat up the slope in front of the advancing beach.

   Seepage through the overburden would be expected to appear as toe seepage along the downslope side of the dump. This water would be intercepted in a toe drain below the western perimeter of the dump for return to the process water storage. Post mining the toe drain would be connected to the final void.

3. Final Void.

   As part of the approved mine plan, overburden and coarse (dry) rejects are to be placed in the completed section of the main pit. Backfilling operations have been ongoing for some time and a general strategy of placing any potentially acid forming material in the lower levels of the void has been implemented. The capacity for storage of waste materials in the void is large and it is expected that the majority of all remaining overburden and coarse reject will be backfilled into the pit.

   At the end of the mining phase there will be a residual void, which will be left to fill with water. The overburden and other materials in the void will saturate to the final water level in the void as a result of the direct hydraulic connection between the loose fill and the rising water level in the void. Any wastes placed below the final water level would therefore be permanently saturated and isolated from atmospheric oxygen.

   Following the mining phase the void could be used for sub-aqueous disposal of washery rejects from Duralie. The capacity of the pit for both coarse (dry) and fine (wet) rejects would be much larger than the quantities of rejects likely to be produced.

4. Roseville Pit.

   Mining of coal in the Roseville pit started in early 1997 and is expected to be completed by the end of 1998. The mined out pit has been identified as being suitable for rejects disposal. It will have capacity for disposal of some 2250 ML of rejects below the final water table level.

5. New Purpose Built Disposal Facility

   The availability of suitable sites for a rejects disposal facility (outside those already identified) is limited by the topographical and drainage constraints of the site to areas immediately south on the main overburden dump (on the western side of Avondale Creek) and areas adjacent to the rail loop on the eastern side of the creek. Development of a new facility in either area would offer no economic or environmental advantages to other options considered and would involve increased environmental risk, greater land disturbance and construction and rehabilitation costs. This option has not been considered as necessary for rejects disposal at Stratford as currently conceived.

   There will however be a need to construct a small, temporary out-of-pit storage for containment of Duralie washery rejects until the Roseville pit becomes available for permanent reject disposal. Once the Roseville pit is available the rejects stored in the temporary storage area would be transferred (by slurry pump) to the Roseville pit for permanent disposal below water level. The storage would comprise a lined 'Turkey's nest' dam adjacent to the Roseville pit (refer Figure 1). It would be sized to store the first 6 months of washery reject production from Duralie coal plus a freeboard for storm water. The spillway from the storage would convey any overflow to Roseville pit. CIM expect that the storage will be required for a maximum of 6 months production.

5.2 Rejects Disposal Scheme

The rejects disposal plan is based on placement of Duralie rejects below ground level and below the final groundwater level. The plan involves backfilling the Roseville void to below final water level and use of the Stratford final void as a receptacle for remaining Duralie rejects. Because mining at Roseville will not be completed for up to 6 months after Duralie coal is planned to be brought to Stratford, a purpose built temporary cell will be constructed adjacent to the Roseville pit to provide temporary storage of all Duralie washery rejects produced over this initial period.

Washery rejects from Stratford Coal would be pumped to the western reject disposal area. The capacity of this facility would be fully utilised by mid 2004 at which stage washery rejects produced from Stratford Coal would be pumped to the eastern emplacement area. The expansion of the western reject disposal area would result in a larger elevated landform to the north and west of the current disposal area limits. The expanded area would be contained entirely within the current mine lease limits. The final landform is shown on Figure 1, and would feature a rounded hill that would be constructed to blend in with the existing ridgeline between The Bucketts Way and the mine site.

A proportion of the bath rejects from Stratford would be used for covering and construction of internal embankments in the western reject containment, and as cover material in the eastern reject disposal area. The bulk of the bath rejects from Stratford coal would however be used as backfill in the lower levels of the main pit.

The proposed reject disposal schedule for Stratford coal rejects is summarised in Table 3.

Table 3
Schedule of Rejects Disposal – Stratford Coal
(Thousands of Tonnes)

YEAR						
1999/2000	**2000/2001**	**2001/2**	**2002/3**	**2003/4**	**2004/5**	**Total**
364	375	346	363	339	376	2880
334	345	316	333	309	346	2670
30	30	30	30			150
				30	30	60
728	750	693	726	678	752	5,223
728	750	693	726	57		3850
				621	752	1373

(Source CIM Resources)

During the initial 6 months, production of washery rejects from Duralie coal would be disposed as a slurry into a temporary storage cell constructed adjacent to the Roseville pit. This structure would provide secure containment while mining of Roseville is completed.

During this phase the rejects would be dosed with lime at 10kg/tonne in the washery prior to discharge to control acid and sulphate generation. Following completion of mining at Roseville the contents of the temporary storage would be slurried into the Roseville pit below water level. Additional Duralie rejects would also be discharged into the Roseville pit to a maximum final level of RL114, (which is estimated to be the limit to which rejects would remain permanently below final water level). Rejects produced from Duralie coal after that time would be discharged to the final Stratford mine void.

A minimum 0.5m submergence would be maintained over the rejects during the disposal phase. The discharge point would be moved around the sides of the voids to facilitate development of a uniform reject deposit and maintenance of the water cover, which would provide isolation of the rejects from atmospheric oxygen. (Refer Figure 3 and Figure 4.).

The bath rejects from Duralie Coal would be placed dry in the lower levels of the main pit. The material would be paddock dumped by truck and spread by grader into 0.5 to 1m layers. Each layer of bath rejects would, if necessary, be dosed with crushed limestone to control the onset of acid generation. Bath rejects would be covered with at least 10m of non-acid forming (NAF) overburden from the Stratford mine.

The proposed reject disposal schedule for Duralie coal rejects is summarised in Table 4.

Table 4
Schedule of Rejects Disposal – Duralie Coal
(Thousands Tonnes)

	YEAR							
	1999/2000	**2000/1**	**2001/2**	**2002/3**	**2003/4**	**2004/5**	**2005/6**	**Total**
	105	289	130	130	130	130	130	1,064
	105	289	130	130	130	130	130	1,064
	420	480	520	520	520	520	520	3,580
	105							
	500*	480	520	520	455			2,475
					65	520	520	1,105

storage cell.

(Source CIM Resources)

5.3 Water Management

The hydrological behaviour of the rejects areas during the active disposal operations and post rehabilitation has been investigated using the SOILCOVER Model (MEND, 1996). SOILCOVER is a one-dimensional saturated/unsaturated transient water flow model that simulates moisture flux to and from soil and atmospheric boundaries. The model was used to assess the relative amounts of water that are likely to appear as runoff, seepage, evaporate or report as deep percolation from the reject disposal areas.

The model simulations were set up to represent a typical profile through the final western reject disposal area. The results of these simulations indicate that under typical climatic conditions:

1. During the operational phase, inactive but uncovered areas within the above ground reject disposal areas will generate minimal runoff. Seepage/infiltration rates will on the other hand be quite high (20 to 25% of rainfall). Active areas and slimes will remain saturated and generate high runoff which would report to decant areas.
2. Infiltration and seepage from covered and rehabilitated areas would be approximately 6% and 1.0% of rainfall respectively. Runoff would account for some 10%.

   These estimates were based on the following (preliminary) cover design:

   - a combined subsoil and topsoil cover of nominal thickness of 0.9m (comprising a 300 mm thick topsoil layer underlain by a 600 mm thick compacted clay layer);
   - separation of the cover from the underlying washery rejects by a coarse (well-drained), layer of bath rejects or other similar material to act as a capillary break layer; and,
   - a healthy vegetative cover,
3. Upward flux through the capillary breaking layer of the rehabilitated cover works will be minimal, leading to low potential for salt rise within the cover.
4. Rejects in the Roseville Pit and Stratford final void would remain saturated.

The water management requirements for the reject disposal areas comprise:

1. Western Rejects Co-disposal Area

Toe drains are aligned around the perimeter of the reject emplacement area, and runoff/seepage is directed to the return water dam. The internal disposal cell embankments have been constructed of coarse reject material to facilitate drainage of slurry water to the return dam through the profile of the rejects, and this would continue while rejects placement continued to be undertaken in this area.

2. Eastern Rejects Disposal Area

Following transfer of washery rejects to the eastern disposal area, return water will be required to be pumped from the disposal area to the return dam for use in the process plant. The collection and return of water from the eastern disposal area would be undertaken as shown in Figure 2. The rejects discharge point(s) would be moved to create a sloping beach to promote drainage of water to a low point that would effectively form a decant pond. A pump on a floating pontoon would be located within the pond with return water and runoff transferred to the return water dam. Pumping capacity would be required to be (as a minimum) equivalent to the plant demand (7.39 ML/day or 85 L/s) so as to ensure maintenance of reliability of supply and maximise recovery.

3. Roseville Pit

Return water from Roseville Pit will be pumped to the return dam for use in the CPP. Management of Duralie Coal rejects will include maintenance of a water cover over the reject material. A low point would be formed by moving the rejects discharge point to allow for the formation of a comparatively deep pond within the pit for utilisation as a decant pond. A pump on a floating pontoon would be located within the pond, and return water and runoff transferred to the return dam. Pumping capacity would be required to be (as a minimum) equivalent to the plant demand (7.39 ML/day or 85 L/s) so as to ensure maintenance of reliability of supply and maximise recovery. The pumping system would also be required to be reversible for potential transfer of water to Roseville Pit during extended dry periods, so as to maintain the required minimum cover of water over the reject material.

5.4 Rehabilitation Strategy

The proposed rehabilitation strategy for the reject disposal areas are described below:

Geochemical investigations of reject materials (refer EGi, July 1998), have indicated potential for acid generation from the above ground rejects areas, as well as elevated salt levels. Testwork has indicated that Stratford Coal rejects are expected to be less reactive than Duralie Coal rejects, and will be preferentially placed within the above ground disposal areas. The final surface of the above ground rejects disposal areas will have an engineered cover to control possible acid generation and salt leaching from these areas. This will consist of a capillary breaking layer, a compacted clay cover to restrict oxygen and water ingress into the rejects and therefore potential oxidation of the placed potentially acid forming beach materials, and topsoil for revegetation.

Shaping and profiling of the above ground rejects area would be undertaken to ensure that slopes were stable, with the western area rejects and cell embankments located between the return dam and the rejects battered back to a slope similar to that found in the remainder of the area.

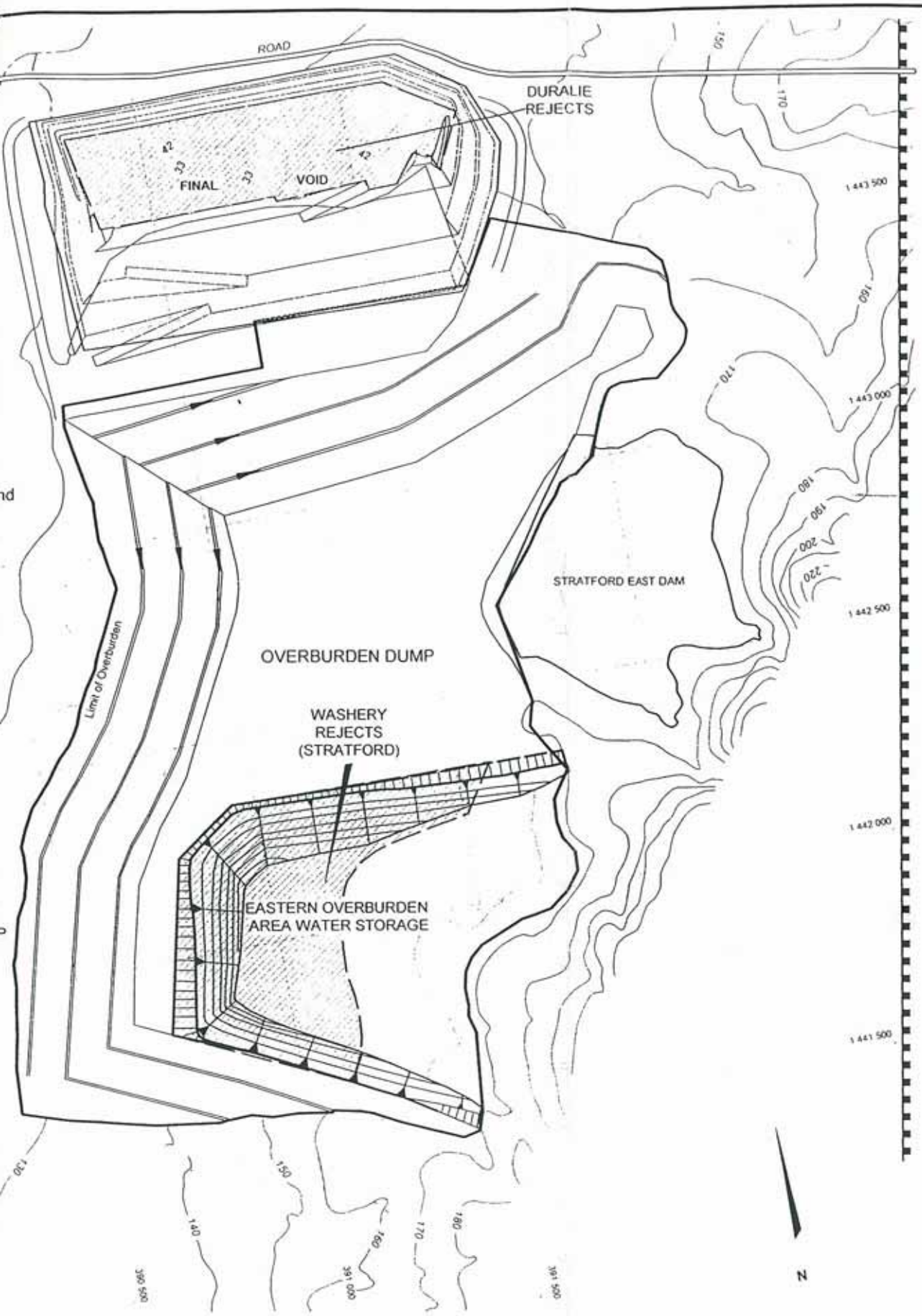
Revegetation of the areas would consist of shallow rooting grasses and shrubs, so as not to impact upon the integrity and effectiveness of the cover works to limit water and air movement into the rejects. Vegetation types would be

selected on the basis of the existing approved mine site rehabilitation plan and would generally include introduced pasture species. Vegetation of the above ground rejects areas would also provide erosion resistance for post-mining land use, such as low density grazing. The vegetation would also lead to increased evapotranspiration rates, thereby reducing potential infiltration into the reject material.

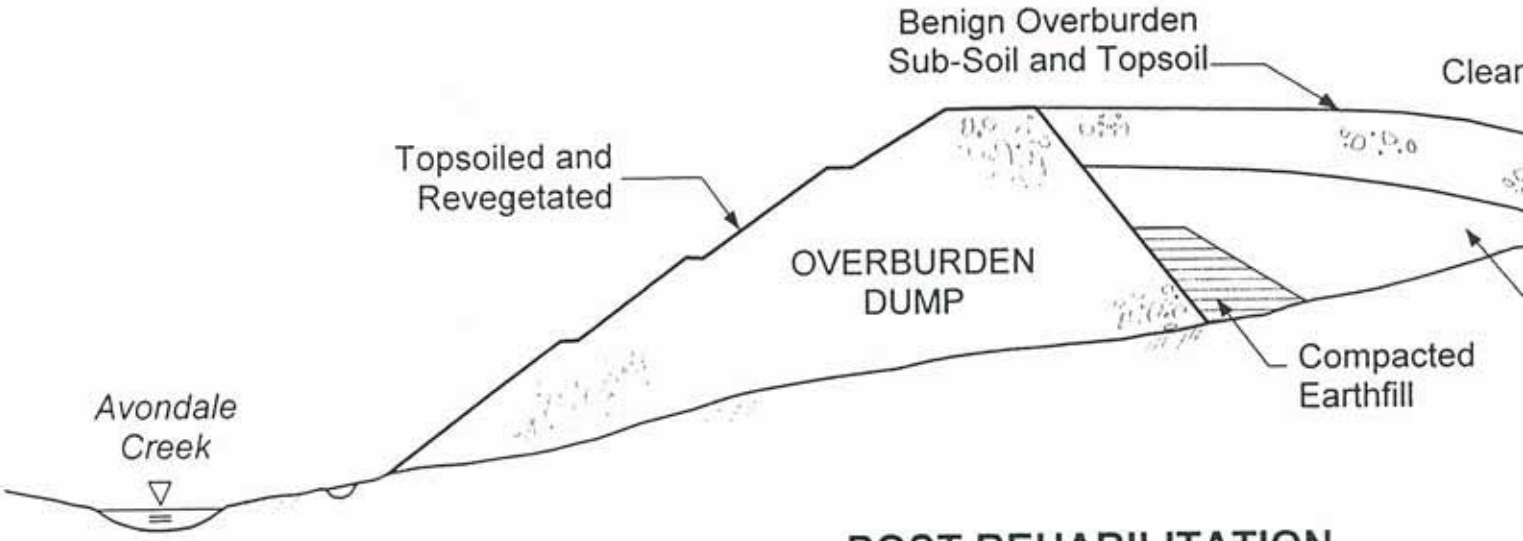
Drainage of the final rehabilitated above ground rejects emplacement areas would be undertaken as shown conceptually in Figure 1. Toe drains constructed along the toe of the western rejects area would be finalised to channel runoff from the 1 in 100 year, critical duration storm event. The return dam wall would be breached, forming a spillway at a level slightly above the floor of the dam with vegetation species sown within the area to promote the formation of a wetland within the dam area.

The Roseville Pit, the void would be backfilled above the final reject level to ground level with benign overburden. The natural drainage lines would be reinstated and the area revegetated.

FIGURES



SCALE: As Shown	GILBERT AND SUTHERLAND PTY LTD	
DRAWN: AUSMEC	Soil and Water Resource Consultants	
CHECKED: G & S	REJECTS DISPOSAL SCHEMATIC LAYOUT	
REV:		
DATE: August, 1998	DWG No: BJ9701-3-D-001	FIGURE: 1



POST REHABILITATION

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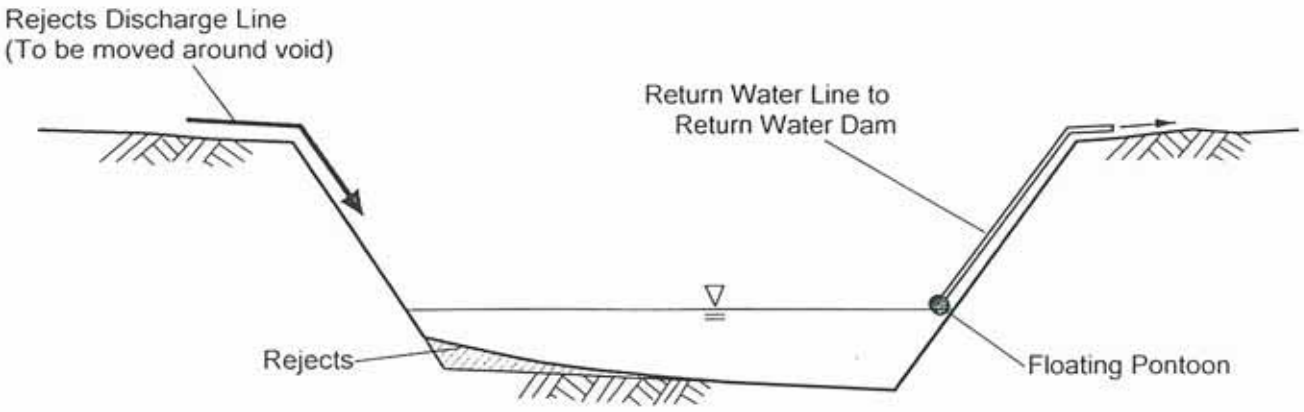
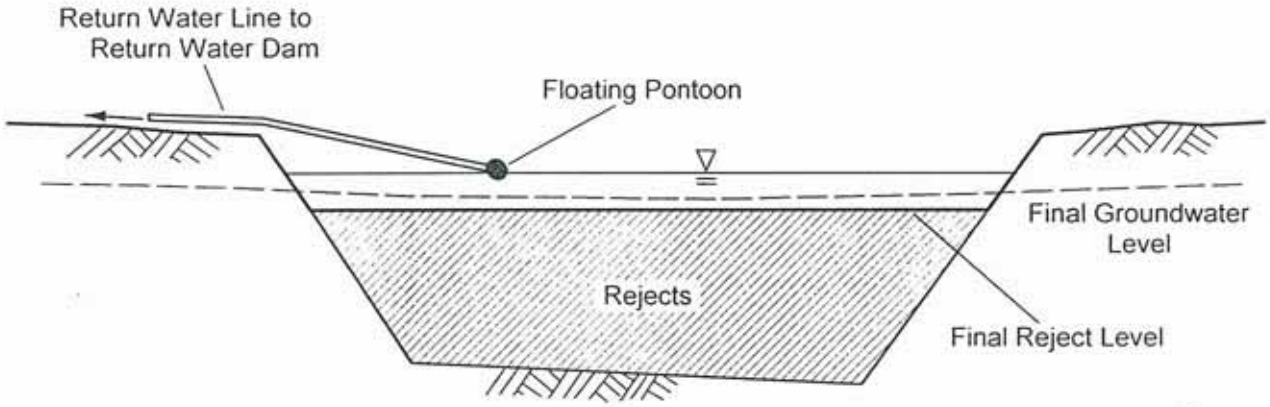
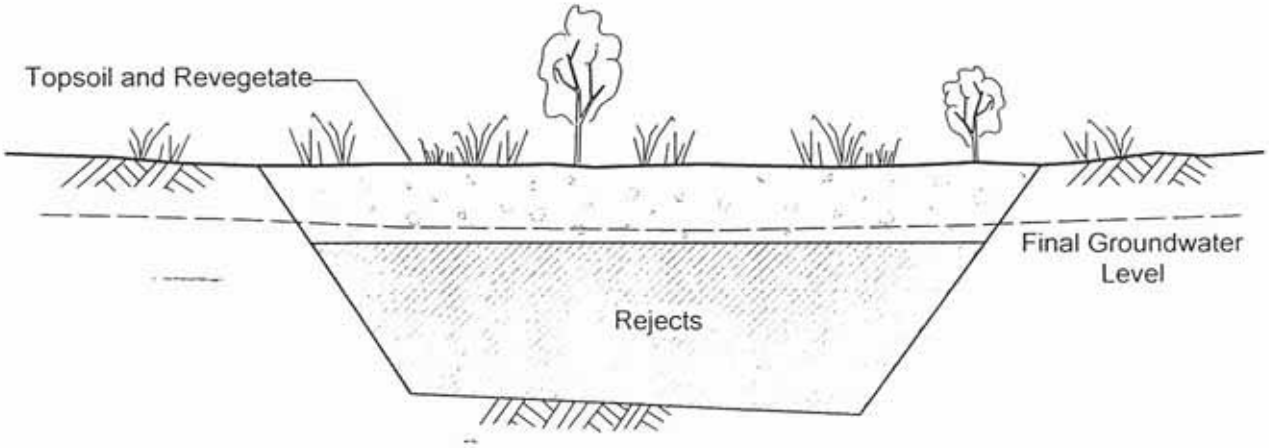
		CHECKED: G & S	EAST
PROJECT: AMENDED REJECTS DISPOSAL PLAN		REV:	
		DATE: August, 1998	DWG No: B



INITIAL REJECT DISPOSAL OPERATIONS



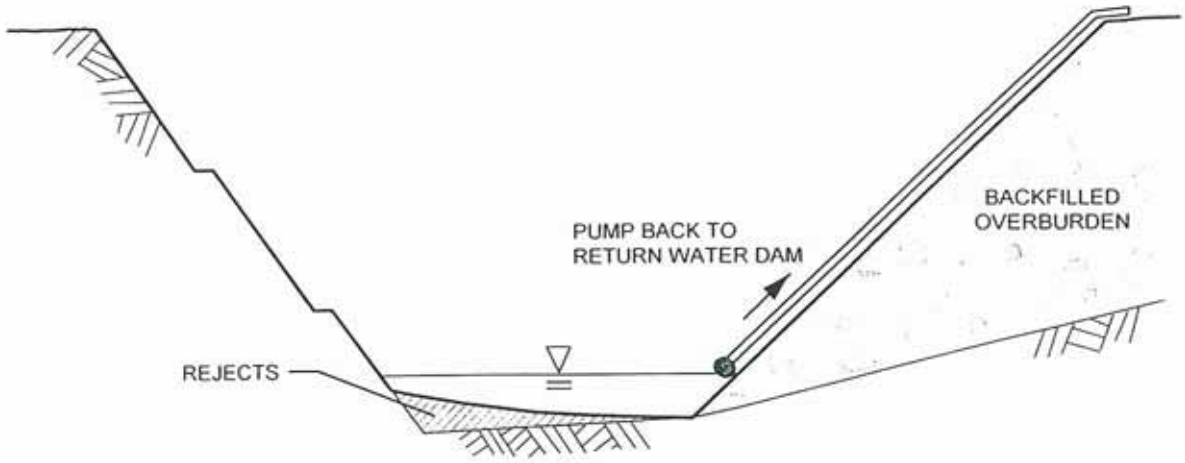
FINAL REJECT DISPOSAL OPERATIONS



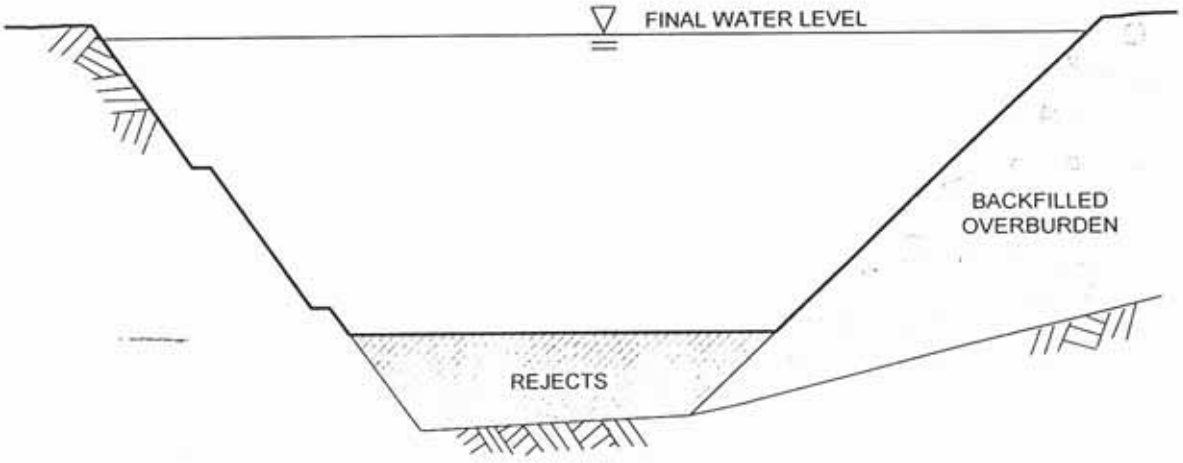
REHABILITATED FINAL VOID

NOTES: - Reject disposal discharge point and pump return retreat up pit walls with rejects placement

CLIENT: CIM RESOURCES	SCALE: Not to Scale	GILBERT AND SUTHERLAND PTY LTD	
	DRAWN: AUSMEC	Soil and Water Resource Consultants	
	CHECKED: G & S	DURALIE WASHERY REJECT DISPOSAL TO ROSEVILLE PIT	
PROJECT: AMENDED REJECTS DISPOSAL PLAN	REV: B		
	DATE: August, 1998	DWG No: BJ9701-3-D-003	FIGURE: 3



INITIAL REJECT DISPOSAL TO FINAL VOID



FINAL REJECT DISPOSAL - POST REHABILITATION

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PROJECT: AMENDED REJECTS DISPOSAL PLAN	REV: A		
	DATE: August, 1998	DWG No: BJ9701-3-D-004	FIGURE: 4

APPENDIX A

EGi Rejects Geochemistry Reports

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November 1997

Document No. 6903/332

Stratford Coal Mine

GEOCHEMICAL ASSESSMENT OF COAL REJECT DISPOSAL OPTIONS

STAGE 1: GEOCHEMICAL CHARACTERISATION OF COAL REJECT AND SPOIL

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1.0 Introduction

Stratford Coal Pty Ltd are currently reviewing options for disposal of coal rejects at the Stratford Coal Mine. A likely disposal strategy will be the co-disposal of coarse rejects and fines, within out-of-pit or in-pit spoil dumps. Environmental Geochemistry International (EGi) were commissioned by Stratford Coal Pty Ltd to undertake an environmental geochemical investigation of coal rejects and spoil from the Stratford Coal Mine. Field observations and previous investigations carried out by HLA Envirosciences Pty Ltd have indicated acid spoil concerns. In particular the carbonaceous spoil material and coal reject materials have been identified as having moderate sulphur concentrations and high pyritic sulphur to sulphate sulphur ratios. These reported sulphur concentrations and the occurrence of pyrite, in the coal rejects and carbonaceous spoil, pose a potential concern for acid development and acid drainage in the existing disposal facility and any future disposal facilities. Based on the above, a two-stage geochemical testing program was recommended. This report presents the results and findings of the first stage.

The specific objectives of the first stage geochemical investigation are to:

- Determine the geochemical characteristics of coal rejects and spoil from the Stratford Coal Mine. This included assessment of the acid forming characteristics, sulphide reactivity and multi-element composition.

- Identify any geochemical implications likely to arise from the current waste management activities.

- Make recommendations for further geochemical testing (Stage 2).

2.0 Geochemical Assessment Program

2.1 Sample Selection and Description

The following samples were supplied by the Stratford Coal Mine:

- Coal Rejects:
  Scalped coarse rejects (three samples)
  Beach deposited co-disposed coarse rejects and tailings (three samples)
  Slimes from toe of beach (three samples)

  Scalped coarse rejects consist of material which is scalped off the feeder before it reaches the coal preparation plant (CPP). This material is trucked to the co-disposal area for use in wall construction. Beach deposited co-disposed coarse rejects and tailings consist of tailings and coarse rejects which are pumped together to the co-disposal area for beach deposition. The slimes are the material that separate out from the co-disposed rejects and tailings near the toe of the beach.

- Spoil:
  Clay (three samples)
  Mudstone (three samples)
  Sandstone (three samples)
  Carbonaceous Material (three samples)

  The carbonaceous material is referred to as carbonaceous waste or black waste.

The samples for geochemical testing were selected and collected by personnel from the Stratford Coal Mine. All samples were sent at field moisture content.

2.2 Sample Preparation

The sandstone, mudstone, carbonaceous material and coarse reject samples were half split and then crushed. The bulk samples were riffle split to obtain a 200 g sub-sample, which was then pulverised for testing. The clay samples, beach deposited and co-disposed coarse rejects and tailings, and co-disposed slimes were split to obtain a 200 g sub-sample, which was then pulverised for testing. All sample preparation was carried out by Enviromet Operations Pty Ltd.

2.3 Testing Program

The testing program for evaluating the acid forming characteristics of the samples included pH and electrical conductivity determination, total sulphur assay, Acid

Neutralising Capacity (ANC) and static Net Acid Generation (NAG) testing. Based on the results of the static NAG testing, four samples were selected for kinetic NAG testing. The testing program also included multi-element analysis of the solids of seven selected samples.

2.4 Analytical Methods

Assessment of Existing Acidity and Salinity

- pH - measured in deionised water at a sample:water ratio of 1:2 (w/w) after a minimum of 1 hour equilibration.
- Electrical Conductivity - measured in deionised water at a 1:2 sample:water ratio after a minimum of 1 hour equilibration.

Assessment of Acid Forming Potential

- Total Sulphur content - by the Leco high temperature combustion method.
- Maximum Potential Acidity (MPA) - calculated from the total sulphur results (refer to Section 2.6 for more details).
- Acid Neutralising Capacity (ANC) - by addition of acid to a known weight of sample, then titration with NaOH to determine the amount of residual acid (refer to Section 2.6 for more details).
- Net Acid Producing Potential (NAPP) - calculated from MPA and ANC results (refer to Section 2.6 for more details).
- Net Acid Generation (NAG) - by the hydrogen peroxide oxidation method. The method involves the addition of 250 ml of 15% H_2O_2 to 2.5 g of pulverised sample. The sample is allowed to react overnight, then after boiling and cooling the pH and acidity of the NAG liquor are measured.

Assessment of Sulphide Reactivity and Acid Generation Kinetics - 4 samples only

- Kinetic NAG tests (four samples only) - by the hydrogen peroxide oxidation method with temperature and pH changes monitored throughout the reaction (refer to Section 2.6 for more details).

Assessment of the Multi-element Content of Solids - 7 samples only

- Multi-element content (seven samples only) - by initial acid digestion of the solids followed by analysis using a combination of ICP-mass spectroscopy

(ICP-MS), ICP-optical emission spectroscopy (ICP-OES), and atomic absorption spectrometry (AAS).

2.5 Analytical Laboratories

The Measurements of pH, EC, ANC, NAG, and kinetic NAG tests, were carried out by EGi in their in-house laboratory in Sydney. Enviromet Operations Pty Ltd in Sydney carried out total sulphur assays, and Genalysis Pty Ltd in Perth carried out multi-element scans on the solids. Enviromet and Genalysis have NATA registrations for these analyses.

2.6 Explanation of Terms

This section provides a brief explanation of the terms commonly used in the assessment of enriched elements and acid forming potential. It should be noted that different terminology has been adopted overseas and at other laboratories, and comparable terms are listed in the footnote[1] below.

Assessment of Enriched Elements

A measure of the extent of element enrichment within each sample was obtained by comparing the assay result of each element with the average crustal abundance for that element (Bowen, 1979[2]; Berkman and Ryall, 1976[3]). The extent of enrichment is reported as a Geochemical Abundance Index (GAI) which relates the actual concentration with the crustal abundance on a log 2 scale.

The GAI is expressed in 7 integer increments (0 through to 6, respectively), where a GAI of 0 indicates the element is present at a concentration similar to, or less than, average crustal abundance and a GAI of 6 indicates approximately a 100-fold, or greater, enrichment above average crustal abundance.

The main purpose of the GAI is to identify any elements (especially metals) that occur at concentrations which are well above normal background values and which warrant further examination to assess their environmental significance. As a general

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[1] Alternative terminology is sometimes used when describing the acid forming characteristics of mine waste materials. For following terms are equivalent:
ANC = NP (neutralising potential)
NAPP = (-)NNP (net neutralising potential)
MPA = AP (acid potential)

[2] Bowen, H.J.M. (1979). Environmental Chemistry of the elements. Academic Press, New York, p36-37.

[3] Berkman, D.A. and Ryall, W.R. (1976). Field Geologists' Manual. The Australian Institute of Mining and Metallurgy, Parkville Victoria, p44-45.

rule, a GAI of 3 or greater signifies enrichment to a concentration that warrants further examination.

Assessment of Acid-Base Account and Net Acid Producing Potential

The first step in assessing the acid forming potential of each sample was to carry out an acid-base account. This involved static laboratory procedures that evaluate the balance between acid generation processes (oxidation of sulphide minerals) and acid neutralising processes (dissolution of alkaline carbonates, displacement of exchangeable bases, and weathering of silicates).

The values arising from the acid-base account are referred to as maximum potential acidity (MPA) and the acid neutralising capacity (ANC), respectively. The difference between the MPA and ANC values is referred to as the net acid producing potential (NAPP).

The chemical and theoretical basis for the MPA, ANC and NAPP values are as follows:

Acid Neutralising Capacity - Any acid formed from pyrite oxidation will to some extent react with other gangue minerals within the sample solids. This inherent acid buffering is quantified in terms of the ANC. The ANC measurement involves a standard addition of hydrochloric acid to a sample, allowing time for the acid and sample to react, then back-titrating the residual acid with sodium hydroxide. The amount of acid consumed during the reaction represents the inherent acid neutralising capacity of the sample and is expressed in units of kilogram of H_2SO_4 consumed per tonne of material (*i*.e. kg H_2SO_4/t).

Maximum Potential Acidity - The total sulphur content is commonly used to calculate the maximum potential acidity (MPA) that can be generated by a sample. In doing so, it is assumed that all the sulphur occurs as pyrite (FeS_2) and that the pyrite reacts under oxidising conditions to generate acid according to the reaction:

$$FeS_2 + 15/4O_2 + 7/2H_2O = Fe(OH)_3 + 2H_2SO_4$$

According to this reaction, the MPA for a sample containing 1 %S as pyrite would be 30.6 kilograms of H_2SO_4 produced per tonne of material (*i*.e. kg H_2SO_4/t). Hence the MPA is calculated as %S x 30.6. The use of the total sulphur assay usually provides a conservatively high estimate of the MPA because some sulphur usually occurs in forms other than pyrite. Sulphate-sulphur and native sulphur, for example, are non-acid generating and some other metal sulphides yield less acid than pyrite when oxidised. Allowance for the non-acid generating sulphur forms (e.g. by subtracting any sulphate-sulphur content from the total sulphur content) provides a more accurate measure of MPA.

Net Acid Producing Potential - This is a theoretical calculation commonly used to indicate if a material has potential to acidify and produce acidic drainage. It

represents the balance between a sample's capacities to generate acid and to neutralise acid. The NAPP is expressed in units of kg H_2SO_4/t and is calculated as follows:

$$NAPP = MPA - ANC$$

Where the MPA and ANC measurements are also expressed as kg H_2SO_4/t. If the MPA is less than the ANC then the NAPP is negative and it is likely that the sample will have sufficient ANC to prevent acid generation. Conversely, if the MPA exceeds the ANC then the NAPP is positive and there is a possibility the material may be acid forming. Any material that already has a natural pH less than 4 and a positive NAPP value is considered to be acid forming.

Assessment of Net Acid Generation

Net acid generation tests were carried out on all spoil and coal reject samples. Unlike the somewhat theoretical NAPP approach, the NAG test directly evaluates the net acid generating potential without estimating the acid potential and the acid neutralising capacity separately. The NAG test involves the addition of unstabilised hydrogen peroxide to a sample to oxidise any reactive sulphides boiling, measurement of the solution pH (NAG pH) and then titration of any acidity produced by the oxidation reaction.

During the NAG test, both acid generation and acid neutralisation reactions can occur simultaneously, therefore the end result represents the net amount of acid generated by the sample. The net acid generated is quantified by titration with NaOH to pH 4.5 and is referred to as the NAG capacity (kg H_2SO_4/t).

Generally when the final NAG pH is ≥ 4 the sample is classified as non-acid forming (NAF) and when the final NAG pH is < 4 the sample is classified as potentially acid forming (PAF). PAF samples are further classified as potentially acid forming - low capacity (PAF-LC) if their NAG capacity is less than 5 kg H_2SO_4/t, and potentially acid forming - high capacity (PAF-HC) if their NAG capacity is greater than 5 kg H_2SO_4/t.

Kinetic NAG tests were carried out on four selected spoil and coal reject samples. The kinetic NAG test is similar to a standard NAG test, but in addition, temperature and pH changes are constantly monitored during the test to provide an indication of reaction kinetics. The temperature and pH profiles are used to predict the lag period, i.e. the exposure time, required in the field for a PAF material to react and produce acidic conditions.

3.0 Geochemistry of Mine Waste

The pH, EC, ANC, NAG test results, and acid forming characteristics for the 21 spoil and coal reject samples, are given in Table 1.

3.1 Natural pH and Salinity

The pH and EC measured on a 1:2 w/w water extract (pH_{12} and EC_{12}) give an indication of the immediate natural acidity and salinity of the waste material when exposed in a waste emplacement area.

Spoil

All of the spoil samples tested were naturally neutral to alkaline (pH_{12} 7.0 to 9.0). The sandstone, mudstone and carbonaceous material samples were non-saline (EC_{12} < 0.5 dS/m) and the clay samples were slightly saline (EC_{12} = 0.5-1.0 dS/m). This suggests that initial drainage from spoil will be neutral to alkaline and contain relatively low concentrations of soluble salts.

Coal Rejects

All of the coal reject samples tested were naturally neutral to alkaline (pH_{12} 7.7 to 8.3). The DMB-reject samples were non-saline (EC_{12} < 0.5 dS/m) and the co-disposed beach deposit and co-disposed slime samples were slightly saline (EC_{12} = 0.5-1.0 dS/m). The coal reject samples generally had a higher salinity than the spoil samples, however the initial drainage from coal rejects will still contain relatively low concentrations of soluble salts.

3.2 Acid Forming Potential

Spoil

Sulphur concentrations in the spoil samples tested ranged from 0.01 to 0.57 % S, with an average concentration of 0.15 % S. The total ANC values of the spoil samples ranged from 3 to 51 kg H_2SO_4/t, with an average total ANC of 25 kg H_2SO_4/t. The results indicate that the total ANC's of the carbonaceous materials are low (< 10 kg H_2SO_4/t) while all other material types have moderate total ANC values.

The carbonaceous material samples had the highest average sulphur content (0.46%S) of all the spoil material types. The sulphur contents of the samples were moderately high and their total ANC's were low, hence their NAPP

values were slightly positive, ranging from 7 to 9 kg H_2SO_4/t.
Most of the spoil samples tested (i.e. 9 out of 12) were NAPP negative, and the remaining three samples had only slightly positive NAPP values. The three samples with positive NAPP values were the carbonaceous material samples.

Coal Rejects

Sulphur concentrations in the coal reject samples tested ranged from 0.22 to 1.34 % S, with an average concentration of 0.62 % S. The total ANC in the coal reject samples was moderate ranging from 9 to 37 kg H_2SO_4/t, with an average of 23 kg H_2SO_4/t.

The co-disposed beach deposited reject samples had the highest average sulphur contents (0.90%S) followed by the co-disposed slime samples (0.69%). The sulphur contents of these samples were moderately high and their total ANC's were low to moderate (9 to 37 kg H_2SO_4/t), hence their NAPP values were either negative or only slightly positive, ranging from - 17 to 9 kg H_2SO_4/t. However, if the relatively high concentrations of sulphur (0.22 to 1.34%) in these materials occurs as reactive sulphides then generation of sulphate salts is likely to occur when they are exposed to surficial oxidation processes. This will be an ongoing process as long as the reactive sulphides remain exposed to oxidation.

The results of the NAG and NAPP tests performed on the coal and spoil samples were compared to one another, to further evaluate their acid generating potential. Figure 1 is a plot of NAPP versus NAGpH for the 21 samples tested. The results show that all NAPP negative samples (except one) had NAGpH values significantly greater than 4 (all were greater than NAGpH 5.4) and these samples are therefore confirmed as non-acid forming (NAF). The NAF samples represent all of the sandstone, mudstone and clay spoil samples, all of the DMB reject samples, as well as one co-disposed slime sample.

Four of the seven NAPP positive samples had NAGpH values less than 4, and these samples are confirmed as potentially acid forming (PAF). The PAF samples represent all of the carbonaceous mudstone spoil samples and one co-disposed beach deposit.

There were four samples with conflicting NAPP and NAG results. The acid generating potential of these samples is uncertain, and test work is required to further investigate materials represented by these samples. Sample CDB2 (a co-disposed beach deposit sample) had a NAGpH less than 4, but a negative NAPP value. The reason for the conflicting NAPP and NAG results on this sample is possibly the occurrence of unavailable or unreactive acid neutralising capacity

(ANC). To further investigate the available or effective ANC of this sample, an acid buffering characteristic curve should be determined. An acid buffering characteristic curve is generated by slowly adding aliquots of acid to the sample and monitoring the pH, to evaluate the buffering capacity to different pH values. This provides a measure of the effective ANC of the sample, which may be less than or equal to the total ANC, depending on the carbonate mineralogy.

There were also three samples (representing co-disposed slimes and co-disposed beach deposit) with NAG pH values greater than 4, which were NAPP positive. The reason for the conflicting NAPP and NAG results on these samples is possibly the occurrence of non-acid generating sulphur forms (e.g. sulphates and organic sulphur). It is recommended that the sulphur forms are determined on these three samples to confirm their expected non-acid forming characteristics.

3.3 Sulphide Reactivity and Acid Generation Kinetics

Kinetic NAG tests were carried out on four samples, two PAF-LC samples and two NAF samples, to better define the reactivity of sulphur and acid generation kinetics in the various material types at Stratford.

Figures 2 and 3 show the temperature and pH profiles recorded for the two NAF coal reject samples (DMB2 and CDS3) during the kinetic NAG test. Sample DMB2 represented DMB reject and sample CDS3 represents co-disposed slimes. Sample DMB2 had a total sulphur content of 0.26%, and with an ANC of 16 kg H_2SO_4/t was found to be NAPP negative (-8 kg H_2SO_4/t). Sample CDS3 had a total sulphur content of 0.63%, and with an ANC of 15 kg H_2SO_4/t was found to be NAPP positive (4 kg H_2SO_4/t). Both samples had NAGpH values greater than 4 and were classified as NAF.

The pH profiles of the two NAF samples show that the pH of the NAG liquor decreased to below pH 3 during the test. However after boiling, the pH of the NAG liquors increased to above 4 which is consistent with the static NAG test results discussed previously. The decrease in pH during the kinetic NAG test is most likely due to reactive organic material, rather than reactive sulphides. Organic acids are destroyed when the NAG liquor is boiled prior to determining the NAGpH.

Some of the inherent total ANC's of these samples may not be reactive. It is therefore recommended that acid buffering characteristic curves are determined for material represented by these samples to confirm the predicted non-acid forming characteristics.

The temperature profiles of the two NAF samples were relatively flat, and the temperature of the NAG liquor remained below 20°C for most of the test, indicating that little or no sulphide oxidation has taken place. This supports the suggestion

that the pH decrease of the NAG liquor during the test was probably due to the presence of organic material in the samples rather than oxidation of reactive sulphides. Materials with these characteristics have a very low risk of generating acid when exposed in the field.

Figure 4 shows the temperature and pH profiles recorded for the PAF-LC coal reject sample CDB2 during the kinetic NAG test. Sample CDB2 represents co-disposed beach deposit rejects with a sulphur content of 0.79% and a moderate total ANC of 32 kg H_2SO_4/t. Sample CDB2 was chosen for kinetic NAG testing because the NAPP value of -8 kg H_2SO_4/t indicated the sample was non-acid forming, but the static NAG test results indicated the sample was PAF-LC.

The pH profile for sample CDB2 indicates that the reactivity of the sample was sufficient to acidify the NAG liquor pH from 5.5 to 2.5 in only 40 minutes. This sample had a negative NAPP value but a NAGpH less than 4, which indicates that in this sample the availability of ANC under NAG test conditions was less than that predicted by the standard ANC method. Again, an acid buffering characteristic curve should be determined for this sample. The temperature profile of sample CDB2 was relatively flat, with only a slight variation in temperature possibly due to some heat generation from sulphide oxidation. It is expected that reject material with these characteristics will generate acid quickly when exposed in the field, but the amount of acid generated will be small (<5 kg H_2SO_4/t).

Figure 5 shows the kinetic NAG temperature and pH profiles recorded for the PAF-LC spoil sample CM1. This sample represents carbonaceous spoil material with a sulphur content of 0.43% and a low total ANC of 6 kg H_2SO_4/t. The pH profile indicates that the reactivity of the sample was sufficient to acidify the NAG liquor pH from 4.3 to 3.3 in approximately 60 minutes. The temperature profile of sample CM1 was relatively flat, with only a slight variation in temperature which was probably due to changes in the ambient temperature of the laboratory during the test. It is expected that spoil material with these characteristics will generate acid quickly when exposed in the field but, like sample CDB2, will only generate small amounts of acid (<5 kg H_2SO_4/t).

3.4 Assessment of Enriched Elements

Multi-element scans were carried out on seven samples, representing each spoil and reject material type, and the results are given in Table 2. The purpose of the analysis was to identify any enriched elements which may be of potential environmental concern with respect to the quality of spoil and reject.

The scans included the following elements:

Major elements	Al, Ca, Fe, K, Mg, Na, Si and S
Minor elements	Ag, As, B, Ba, Be, Bi, Cd, Ce, Co, Cr, Cu, F, Hg, Mn, Mo, Ni, P, Pb, Sb, Se, Sn, Sr, Tl, V, W and Zn.

The assay results for each element were compared with average crustal abundance data to provide an indication of the extent of element enrichment. These comparisons, reported as Geochemical Abundance Indices, are given in Table 3.

As noted in Section 2.6, the main purpose of the GAI is to identify any elements (especially metals) that occur at concentrations which are well above normal background values and which therefore warrant further examination to assess their environmental significance. As a general rule, a GAI of 3 or greater signifies enrichment to a concentration that warrants further examination.

Only sulphur (S), bismuth (Bi) and selenium (Se) were found to occur in significantly high concentrations compared to the average crustal abundance, in one or more of the spoil and reject samples. The significance of elevated sulphur has previously been discussed in Section 3.2 in relation to the acid forming potential of waste materials. Bismuth and selenium are discussed below, and details on their concentration range in the assayed samples; typical concentrations in crustal rock, coal, ash, and associated sediments; and recommended environmental investigation criteria, if available, are presented in Table 4.

Bismuth has a concentration range of 0.2 to 0.5 mg/kg in the spoil materials, and 0.4 to 0.5 mg/kg in the reject materials. These concentrations of Bi are comparable to that of the average world shale (0.48 mg/kg) and are therefore not expected to be of concern.

Selenium has a concentration range of 0.07 to 0.45 mg/kg in the spoil materials and 0.76 to 0.88 mg/kg in the reject materials. These concentrations are high compared to the average crustal abundance (0.05 mg/kg). However the Se concentrations in the reject materials are comparable to that of the average shale (0.6 mg/kg) and typical Australian steaming black coal (0.8 mg/kg). Also Se concentrations in the spoil materials are substantially lower than that of world average shale and typical Australian steaming black coal. Selenium concentrations in all samples assayed are significantly lower than the ANZECC environmental investigation criteria of 3 mg/kg (see Table 3). These findings indicate that concentrations of Se in the reject and spoil are unlikely to be of environmental concern.

4.0 Summary and Recommendations

Twenty-one (21) samples representing the four major spoil material types and the three major coal reject material types at Stratford coal mine were provided to EGi for a two-stage geochemical investigation. The results of the first stage of the geochemical investigation of spoil and coal rejects are presented in this report. A summary of the key findings and recommendations, for spoil and coal reject materials, is given below.

4.1 Spoil Summary

- Mudstone, sandstone and clay spoil materials, represented by the samples provided, are classified as non-acid forming (NAF). The carbonaceous spoil materials represented by the samples provided, are classified as potentially acid forming with a low capacity to generate acid.

- Results of the kinetic NAG test indicate that carbonaceous spoil material is likely to acidify within a short period (weeks) following exposure to atmospheric conditions. However the acid generating capacity is low (<5 kg H_2SO_4/t) and these materials would be amenable to treatment with crushed limestone ($CaCO_3$). The kinetic NAG testing of the carbonaceous material also indicated that some of the inherent total ANC of the sample may not be reactive.

Recommendations

- Acid buffering characteristic curves should be determined for the carbonaceous material, to investigate the effective ANC of the material, during Stage 2 of the geochemical program.

- The risk of acid conditions developing in the carbonaceous spoil material could be reduced or eliminated by addition of crushed limestone at rates of between 1 to 5 kg $CaCO_3$/ha, or blending with higher ANC NAF overburden (such as sandstone, mudstone and clay spoil). Options for run-of-mine blending, liming or burial of the low capacity PAF carbonaceous spoil material should be developed and evaluated, during Stage 2 of the geochemical program. This will involve further NAG testing of blended samples and leach column work.

4.2 Coal Reject Summary

- The DMB-reject materials are classified as non-acid forming (NAF). The acid-forming characteristics of the co-disposed slimes and co-disposed beach deposit materials are yet to be confirmed, however results indicate that co-disposed

slime materials are likely to be non-acid forming (NAF), and co-disposed beach deposit materials are likely to be potentially acid forming with a low capacity to generate acid.

- The coal reject samples had relatively high total sulphur contents. If the sulphur in these materials occurs as reactive sulphides then generation of sulphate salts will occur and will be on-going as long as the reactive sulphides are exposed to weathering processes.

- The low capacity PAF co-disposed beach deposit material has only a short lag period and is expected to develop acid conditions within weeks after exposure to atmospheric conditions.

Recommendations

- Additional test work including; determination of sulphur forms, acid buffering characteristic curves, and leach column testing, is required for the co-disposed slimes and co-disposed beach deposit materials. The results of this additional test work will be used to; confirm the non-acid forming nature of these materials, assess whether sulphate generation from oxidation of reactive sulphides is likely to be of concern, and to investigate the effective ANC of these materials. This test work should be carried out during Stage 2 of the geochemical program.

- The risk of acid conditions developing in co-disposed beach deposited material could be reduced or eliminated by addition of crushed limestone at rates of between 1 to 5 kg $CaCO_3$/ha or blending with higher ANC NAF overburden. Options for run-of-mine control of acid generation also need to be developed and evaluated during Stage 2 of the geochemical program. This will involve further NAG testing and the leach column work.

4.3 General Summary

- Most of the samples had moderate total ANC's however the monitored NAG test results indicated that some of the ANC in the samples tested is of low reactivity and is not available under NAG test conditions.

- Sulphur, selenium and bismuth were the only elements present at significantly high concentrations compared to the average crustal abundance, in one or more of the spoil and reject samples. However comparison of bismuth and selenium concentrations in the spoil and reject samples, compared to typical world average shale concentrations; Australian Steaming Black Coal concentrations; and ANZECC environmental investigation criteria, indicate that these elements are unlikely to be of environmental concern, and require no further geochemical investigation.

forming characteristics of spoil and coal rejects from the Stratford Coal Mine.

Natural pH*	Natural EC* (dS/m)	ACID-BASE ANALYSIS				NAG TEST		Geochemical Classification
		Tot S (%S)	ANC	MPA	NAPP	NAG	Final pH	
			(kg H2SO4/t)					
8.6	0.37	0.03	14	428	-13	0	8.0	NAF
8.9	0.39	0.05	23	704	-21	0	8.4	NAF
8.9	0.41	0.04	17	520	-16	0	8.3	NAF
9.0	0.34	0.05	49	1499	-47	0	8.5	NAF
9.0	0.31	0.06	46	1408	-44	0	8.5	NAF
9.0	0.32	0.07	51	1561	-49	0	8.6	NAF
8.2	0.26	0.43	6	184	7	1	3.7	PAF-LC
7.5	0.36	0.39	3	92	9	3	2.9	PAF-LC
7.2	0.31	0.57	8	245	9	1	3.9	PAF-LC
6.9	0.78	0.02	29	887	-28	0	5.7	NAF
7.2	0.58	0.02	27	826	-26	0	5.7	NAF
7.0	0.81	0.01	28	857	-28	0	5.5	NAF
7.7	0.35	0.36	34	1040	-23	0	5.6	NAF
7.7	0.30	0.26	16	490	-8	0	5.7	NAF
7.8	0.30	0.22	18	551	-11	0	6.3	NAF
8.1	0.57	1.34	35	1071	6	0	4.8	NAF
8.2	0.63	0.79	32	979	-8	1	3.2	PAF-LC
8.3	0.35	0.57	9	275	8	1	3.6	PAF-LC
8.1	0.61	0.79	15	459	9	0	5.5	NAF
8.3	0.79	0.65	37	1132	-17	0	7.8	NAF
8.1	0.83	0.63	15	459	4	0	5.6	NAF

AF = Non-Acid Forming, PAF = Potentially Acid Forming, LC = Low Capacity, HC = High Capacity.

Table 2: Multi-element composition of spoil and coal rejects from Stratford Coal Mine.

Element	Detection Limit	Element Concentration in Solids (mg/kg except where shown)						
		S3	M2	DMB2	CL1	CDB2	CDS3	CM1
		SANDSTONE	MUDSTONE	DMB-REJECTS	CLAY	CO-DISPOSED BEACH DEPOSIT	CO-DISPOSED SLIMES	CARBONACEOUS MATERIAL
Major Elements								
Al	0.02%	6.8%	8.0%	6.0%	7.0%	4.6%	2.5%	0.6%
Ca	0.001%	0.5%	1.1%	0.9%	0.17%	0.54%	0.39%	0.08%
Fe	0.01%	0.94%	4.8%	8.2%	1.7%	1.6%	1.9%	0.76%
K	0.002%	2.4%	2.2%	0.84%	2.1%	1.0%	0.49%	0.23%
Mg	0.002%	0.29%	0.80%	0.30%	0.34%	0.17%	0.10%	0.024%
Na	0.002%	0.94%	0.56%	0.22%	1.2%	0.14%	0.098%	0.044%
S	0.001%	0.030%	0.060%	0.26%	0.020%	0.79%	0.63%	0.43%
Si	0.1%	34%	27%	16%	32%	15%	12%	10%
Minor Elements								
Ag	0.1	<	<	<	<	<	<	<
As	0.5	4.5	6.0	5.0	3.5	9.5	11	3.0
B	50	<	<	<	<	<	<	<
Ba	1.0	310	540	1250	680	1020	285	102
Be	0.1	1.5	2.3	2.1	3.4	2.5	1	0.3
Bi	0.1	0.2	0.5	0.4	0.2	0.5	0.4	0.3
Cd	0.1	<	<	0.2	<	0.2	0.2	<
Ce	0.1	52	70	58	60	52	26	12
Co	1.0	6.0	12	2.0	11	9.0	3.0	1.0
Cr	2.0	30	36	12	30	16	6.0	2.0
Cu	1.0	9.0	21	14	14	32	10	7
F	50	200	400	600	200	350	350	150
Hg	0.1	<	<	<	<	0.2	0.2	0.3
Mn	1.0	84	760	2100	104	330	175	52
Mo	0.5	<	1.0	1.0	<	2.5	1.0	0.5
Ni	1.0	11	16	6.0	9.0	8.0	1.0	6.0
P	20	100	920	4300	100	960	900	340
Pb	2.0	14	18	16	16	16	6.0	4.0
Sb	0.1	<	<	<	<	<	<	<
Se	0.01	0.15	0.32	0.88	0.07	0.78	0.76	0.45
Sn	1.0	2.0	3.0	2.0	2.0	4.0	1.0	<
Sr	0.1	160	270	800	106	175	145	64
Tl	0.2	0.6	0.6	0.4	0.6	0.6	0.2	<
V	2.0	40	102	44	50	64	24	18
W	1.0	2.0	3.0	<	2.0	2.0	<	<
Zn	1.0	46	90	50	56	72	38	16

ootnote

: Signifies element at or below detection limit in sample

Table 3: Geochemical abundance indicies for spoil and coal rejects from Stratford Coal Mine.

Element	* Average Crustal Abundance	Geochemical Abundance Indices (GAI)#						
		S3	M2	DMB2	CL1	CDB2	CDS3	CM1
		SANDSTONE	MUDSTONE	DMB-REJECTS	CLAY	CO-DISPOSED BEACH DEPOSIT	CO-DISPOSED SLIMES	CARBONACEOUS MATERIAL
Major Elements								
Al	8.20%	0	0	0	0	0	0	0
Ca	4.0%	0	0	0	0	0	0	0
Fe	4.10%	0	0	0	0	0	0	0
K	2.10%	0	0	0	0	0	0	0
Mg	2.30%	0	0	0	0	0	0	0
Na	2.30%	0	0	0	0	0	0	0
S	0.03%	0	0	3	0	4	4	3
Si	27.70%	0	0	0	0	0	0	0
Minor Elements								
Ag	0.07	0	0	0	0	0	0	0
As	1.5	1	1	1	1	2	2	0
B	10	0	0	0	0	0	0	0
Ba	500	0	0	1	0	0	0	0
Be	2.6	0	0	0	0	0	0	0
Bi	0.048	1	3	2	1	3	2	2
Cd	0.11	0	0	0	0	0	0	0
Ce	68	0	0	0	0	0	0	0
Co	20	0	0	0	0	0	0	0
Cr	100	0	0	0	0	0	0	0
Cu	50	0	0	0	0	0	0	0
F	950	0	0	0	0	0	0	0
Hg	0.05	0	0	0	0	1	1	2
Mn	950	0	0	1	0	0	0	0
Mo	1.5	0	0	0	0	0	0	0
Ni	80	0	0	0	0	0	0	0
P	1000	0	0	2	0	0	0	0
Pb	14	0	0	0	0	0	0	0
Sb	0.2	0	0	0	0	0	0	0
Se	0.05	1	2	4	0	3	3	3
Sn	2.2	0	0	0	0	0	0	0
Sr	370	0	0	1	0	0	0	0
Tl	0.6	0	0	0	0	0	0	0
V	160	0	0	0	0	0	0	0
W	1	0	1	0	0	0	0	0
Zn	75	0	0	0	0	0	0	0

footnotes

refer to text for explanation of GAI (0 = not enriched -> 6 = highly enriched)

* Bowen H.J.M.(1979) Environmental Chemistry of the Elements.

Table 4: Concentration range in reject and spoil materials; typical concentrations in crustal rocks and coal and related sediments; and recommended environmental investigation criteria for Bi and Se.

Element	Concetration Range in Solids (mg/kg)		Typical Concentrations (mg/kg)			Environmental Investigation Criteria
	Spoil Materials	Reject Materials	[1] Average Crustal Aundance	[2] World Average Shale	[3] Australian Steaming Black Coal	
Bi	0.2 - 0.5	0.4 - 0.5	0.048	0.48	-	NGR
Se	0.07 - 0.45	0.76 - 0.88	0.05	0.60	0.8	[3]

1. Bowen H.J.M. (1979) Environmental Chemistry of the Elements

2. Turekian, K.K. & Wedepohl, K.H. (1961). Distribution of the Elements in Some Major Units of the Earth's Crust. *Geological Society of America, Bulletin 72, 175-192.*

3. Doolan, K.J., Mills, J.C. & Turner, K.E. (1980). Environmental Significance and Analysis of Trace Elements in Coal and Coal Products. BHP Technical Bulletin 24(2), 17-22.

NGR: no guideline recommended

B. ANZECC Environmental Investigation Criteria - Australian and New Zealand Environment and Conservation Council (1992), Australian and New Zealand Guidelines for the assessment and Management of Contaminated Sites.

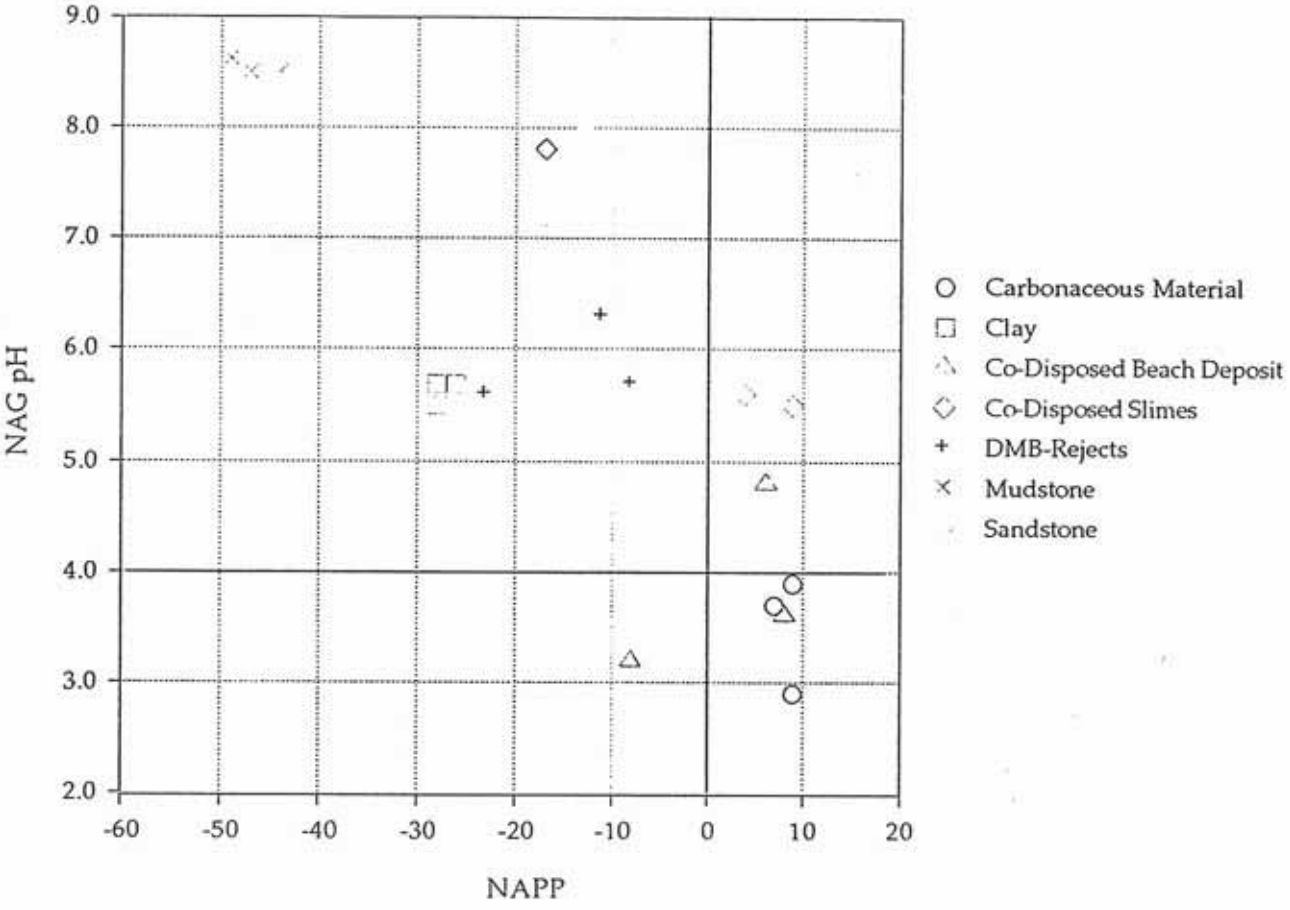

Figure 1: NAPP vs NAGpH for Stratford Coal Reject and Spoil Samples - Split by Material Type

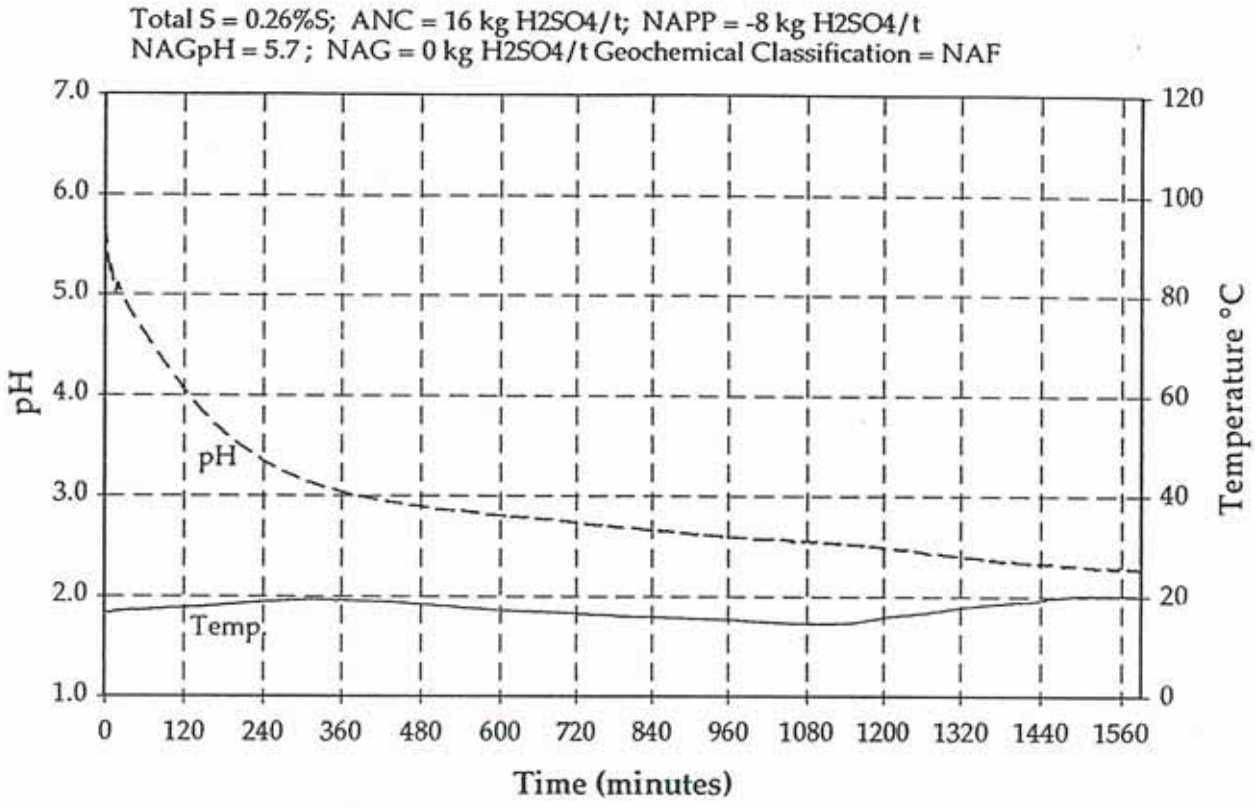

Figure 2: Kinetic NAG Profile for DMB-reject (DMB2).

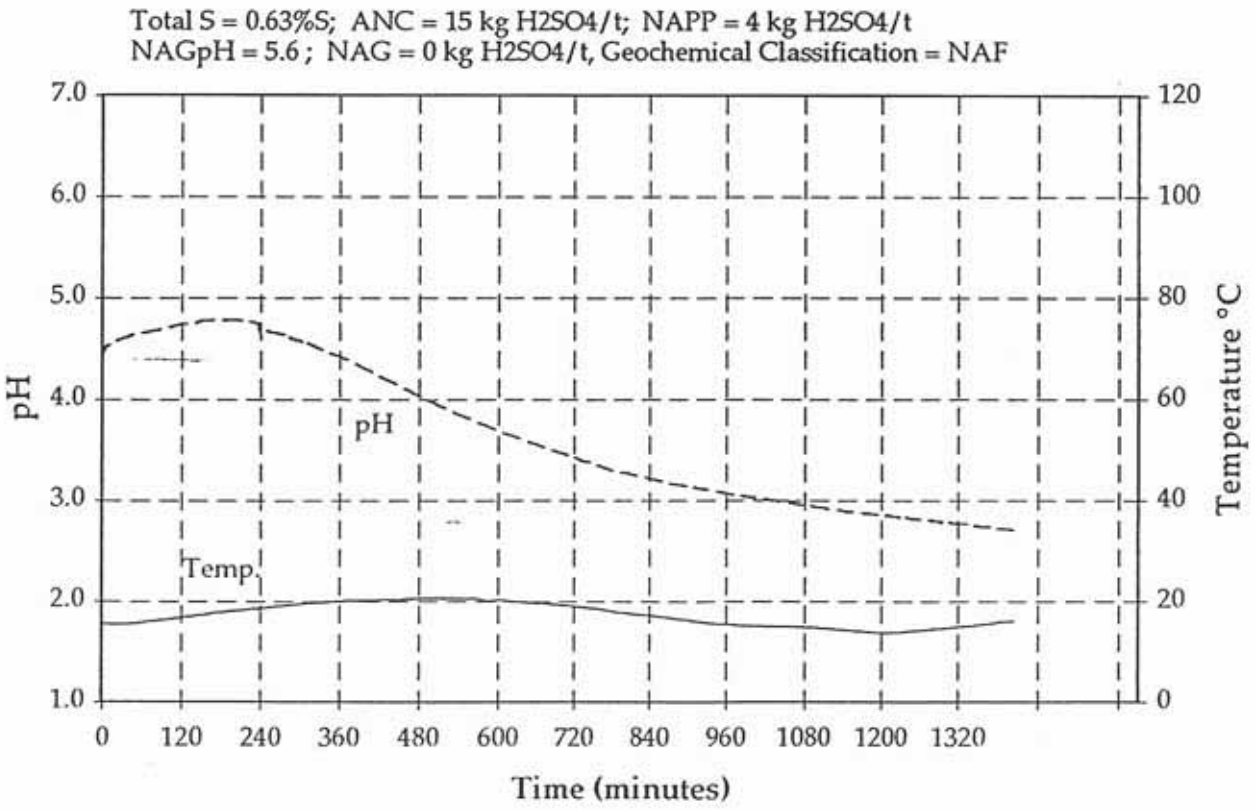

Figure 3: Kinetic NAG Profile for Co-disposed Slime (CDS3).

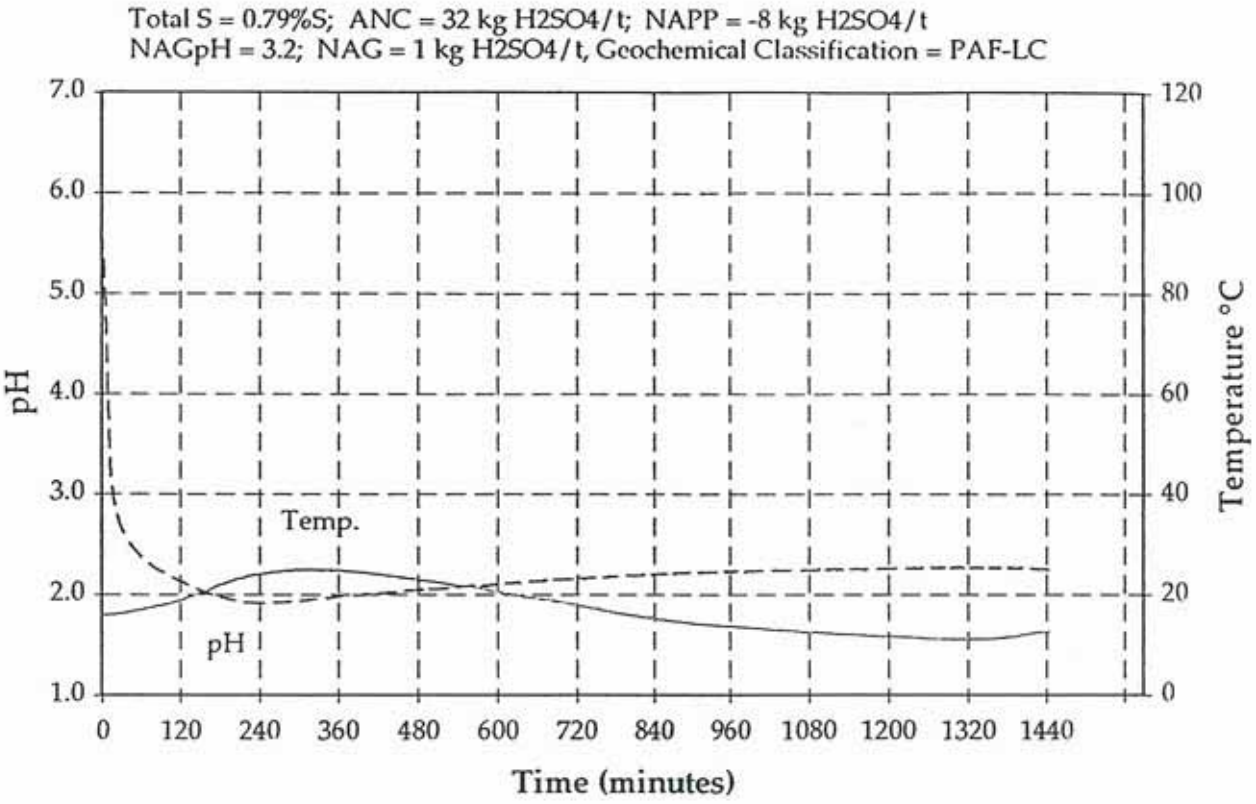

Figure 4: Kinetic NAG Profile for Co-disposed Beach Deposit (CDB2).

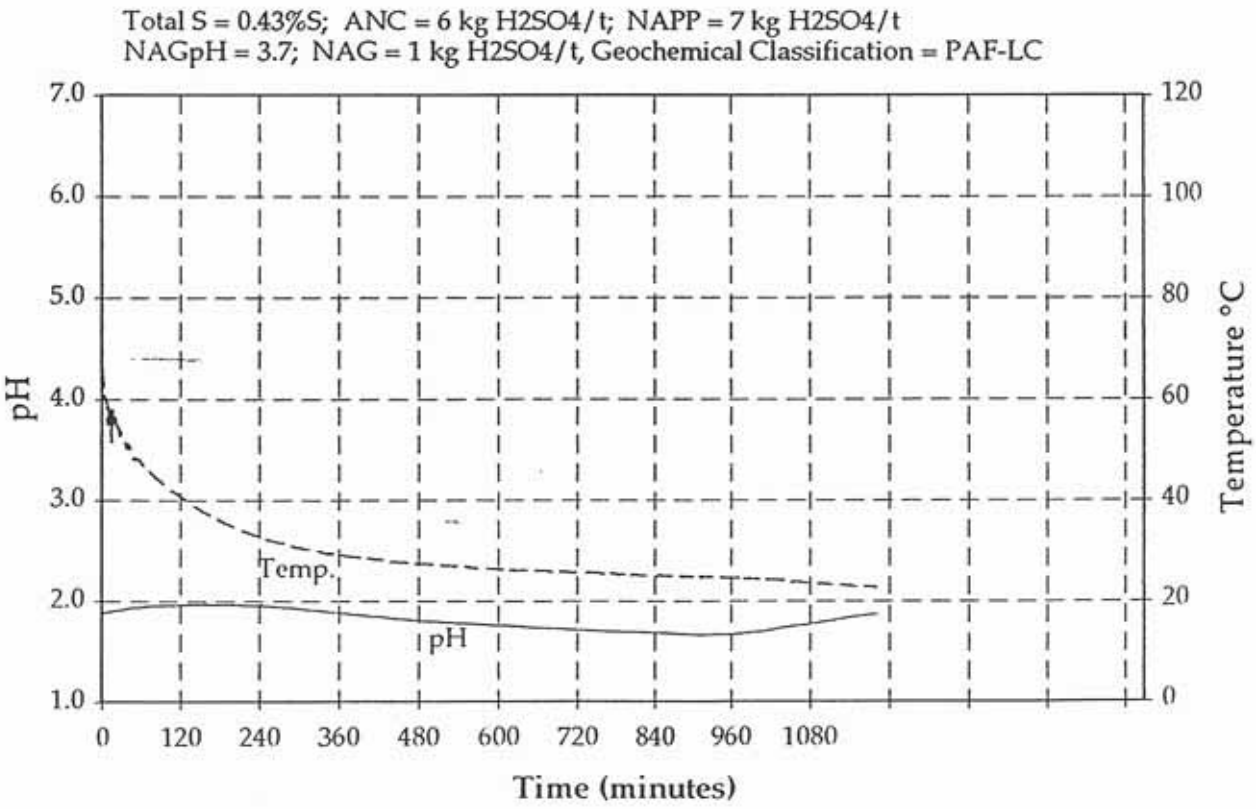

Figure 5: Kinetic NAG Profile for Carbonaceous Material (CM1).

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Stratford Coal Pty Ltd

Mine Site, Bucketts Way, Stratford NSW 2442 Australia

July 1998
Report No.: 6903/362

Stratford Coal Mine

GEOCHEMICAL ASSESSMENT OF COAL REJECT DISPOSAL OPTIONS

STAGE 2: LEACHING BEHAVIOUR OF COAL REJECT

Contents

Tables (after text)

Figures (after text)

1.0 Introduction

1.1 Background

Environmental Geochemistry International Pty Ltd (EGi) were commissioned by Stratford Coal Pty Ltd to undertake an environmental geochemical assessment of coal reject disposal options at the Stratford Coal Mine. The Stage 1 investigations of this project recommended that additional test work be carried out to address potential environmental concerns with the disposal of the coal rejects. Findings from the additional test work (Stage 2) are presented in this report.

It is understood that the coal reject disposal options currently being reviewed include:

1. Expansion of the existing co-disposal facility (coarse reject and tailings) with in-pit disposal of scalpings (DMB rejects).
2. Co-disposal of coarse reject and tailings in isolated cells within in-pit or out-of-pit spoil dumps.
3. In-pit co-disposal of coarse reject and tailings.

The preferred option at this stage is an expansion of the existing co-disposal facility.

1.2 Previous Investigations

Stage 1 investigations were carried out in November, 1997 and involved geochemical characterisation of coal reject and spoil (Ref. EGi Report No. 6903/332, November 1997). These investigations indicated that:

- Most of the spoil materials at Stratford are likely to be non-acid forming (NAF).
- The scalpings (DMB rejects) and co-disposed (coarse reject and tailings) slimes are likely to be NAF. However, the co-disposed beach deposits could be PAF, but will only have a low capacity to generate acid.
- Due to relatively high S concentrations in the coal rejects there is a potential concern for excessive soluble sulphate generation as a result of sulphide oxidation.
- No significant element enrichments of environmental concern, other than S, were detected in the spoil and coal reject solids.

1.3 Study Objectives

The objectives of the Stage 2 investigations are to:

1. Obtain additional information on the acid-base characteristics of the coal rejects (including the ANC availability) and confirm the presence of non-reactive sulphur forms;

2. Determine the limestone blending ratio required to achieve acid-base neutral rejects;

3. Determine sulphide oxidation kinetics and predict sulphate release and seepage chemistry for treated and untreated rejects; and

4. Provide recommendations for environmentally secure disposal of coal rejects at Stratford.

This report is an addendum to the Stage 1 report and presents the results and findings from the Stage 2 investigations. Recommendations for the environmental management of coal rejects at Stratford are also included.

2.0 Geochemical Assessment Program

2.1 Samples Selection and Preparation

The samples used for the Stage 2 testing program were samples retained from Stage 1. These samples included:

Sample Type	*Sample Code*
Scalpings (DMB rejects)	*DMB2, DMB3
Co-disposed** beach deposits	CDB2
Co-disposed** slimes	CDS1

*A composite DMB sample was produced from DMB2 & DMB3

**Co-disposed materials consist of coarse reject and tailings

The samples were selected based on their geochemical characteristics and they are assumed to be representative of the respective material types (i.e. scalpings, co-disposed beach deposits and slimes). Where required, the samples were crushed and pulverised prior to testing.

2.2 Testing Methodology and Program

The testing methodology and program used to geochemically characterise the rejects are discussed in the Stage 1 report. For the Stage 2 testing program the following additional test work was carried out:

- acid-base characteristic curve (ABCC) test
- sulphur forms analyses
- kinetic net acid generation (NAG) test on limestone blended samples
- column leach testing on blended and unblended samples

ABCC Test

The ABCC test is performed by EGi and involves titration of a sample/water suspension with hydrochloric acid. The suspension is made-up of 2 g of pulverised sample mixed with 100 mL of deionised water. The suspension is titrated slowly to pH 2.5 using HCl

addition increments of 0.1 to 2.0 mL depending on the ANC of the sample. After each titrant addition the pH is allowed to stabilise sufficiently before the next addition. The pH is recorded after each titrant addition.

Sulphur Forms Analyses

These analyses were performed by CCI Pty Ltd in Newcastle and included determination of total S, pyritic S and sulphate S.

Kinetic NAG Test

The kinetic NAG test involves monitoring the pH and temperature changes during the oxidation reaction of the standard NAG test. This test is performed by EGi and is used to provide information on reaction kinetics and likely lag periods for acid generation.

Column Leach Testing

Column leach tests that are carried out by EGi provide information on a range of issues including sulphide reactivity, oxidation kinetics and the leaching behaviour of the tested materials. The test period required for the leach columns varies depending on material characteristics and the investigation needs, usually the results are reviewed on a 6 monthly basis. Appendix A provides the design and operation procedures employed by EGi for the column leach testing conducted on the Stratford coal reject samples.

3.0 Geochemical Characteristics of Coal Rejects

3.1 Acid Forming Potential and Reaction Kinetics

The acid forming characteristics of the samples selected for the Stage 2 testing program are provided on Table 1 along with the concentration of the different sulphur forms in these materials. Stage 1 testing indicated that the DMB rejects and co-disposed slimes are likely to be NAF whereas the co-disposed beach deposits could be PAF.

The sulphur forms analysis indicates that 75 to 100 % of the total sulphur in these materials occurs as pyrite with a minor amount occurring as sulphate. The pyritic sulphur concentrations were used to calculate the NAPP values in Table 1.

The NAPP and NAG results from test work undertaken during Stage 1 confirmed that the samples used to make up the DMB composite sample were NAF but provided conflicting data on the other two samples (CDS1 and CDB2). To further evaluate the geochemistry of these samples, acid buffering characteristic curves (ABCC) were generated. The ABCC test is used to determine how effective the ANC is at neutralising sulphide generated acid.

Output plots from the ABCC tests are shown on Figures 1 to 3 and the results are summarised below:

Sample	*Total ANC (kg H_2SO_4/t)*	*Effective ANC (kg H_2SO_4/t)*	*% of Total*
DMB Reject	17	10	58%
Co-disposed Beach Deposit	32	12	38%
Co-disposed Slimes	15	16	100%

These results indicate that all of the ANC in the co-disposed slimes sample is effective, while about 60% is effective in the DMB rejects sample and only 40% in the co-disposed beach deposit sample. The 'effective' ANC's were used to calculate the NAPP values in Table 1.

Using the pyritic sulphur results and effective ANC results to calculate the NAPP values gives different NAPP values to those reported previously.

Findings from the sulphur forms analyses and ABCC tests indicate that:

- the DMB rejects are NAF;
- the co-disposed beach deposits are PAF; and
- the classification of co-disposed slimes is still marginal, these materials are likely to be NAF.

3.2 Limestone Blending and Reaction Kinetics

Kinetic NAG tests were performed on the untreated and limestone treated beach deposit samples to indicate the optimum limestone blend required to negate the risk of acid generation in the field. Results from these tests are expected to be confirmed by the leach column tests. This test involves recording changes in the NAG solution pH and temperature during the NAG reaction. The pH and temperature profiles are then used to indicate the reactivity and likely lag period for the different blends. The blends used were 5 and 10 kg $CaCO_3$/t. The pH and temperature profiles are shown on Figures 4 to 6.

The results show that the 5 and 10 kg $CaCO_3$/t treatments reduced the NAG capacity, but did not prevent acid generation. However, the pH and temperature profiles suggest that the 10 kg $CaCO_3$/t treatment should significantly increase the lag period as demonstrated by the pH profile.

3.3 Leaching Behaviour and Sulphate Generation Rate

The following leach columns were commissioned in December 1997:

Co-disposed Beach Deposit (CDB2)
Co-disposed Beach Deposit (CDB2) blended with limestone at 10 kg $CaCO_3$/t
Co-disposed Slimes (CDS1)
DMB Reject (DMB Composite {DMB 2 & 3})

The results for the first 6 months of leaching are presented on Tables 2 to 5. Column leachate pH, SO_4 concentration and release rate, and the CO_3/SO_4 molar ratio trends over time are also presented on Figures 7 to 11.

The pH trend plots (Figure 7) show that leachates from the DMB rejects and deposited slimes have remained near neutral to alkaline throughout the 6 month leaching period. The pH of the untreated beach deposited material dropped to below pH 4 after 20 weeks of leaching confirming the PAF nature of this material. The limestone treated sample remained above pH 7 to week 20 but has dropped to near pH 6 at week 24.

The SO_4 concentration and release rate trends are shown on Figures 8 and 9, respectively. After an initial flush, SO_4 concentrations in leachates from the deposited slimes decreased to a range of 500 to 1,000 mg/L equating to a longer-term release rate of 30 to 40 mg SO_4/kg/week. The concentration of SO_4 in leachates from the DMB rejects has been lower, ranging from about 200 to 500 mg/L with a release rate ranging from around 10 to 30 mg SO_4/kg/week.

Sulphate concentrations in leachates from the beach deposited material has been relatively consistent at around 1,200 mg/L at a release rate of 70 to 80 mg SO_4/kg/week throughout the leaching period. Sulphate release from the limestone treated beach deposited material has been less than 50% of the untreated sample and is currently at about 20 mg SO_4/kg/week. These results indicate that limestone treatment has been successful in controlling SO_4 release and maintaining SO_4 concentrations at about 500 mg/L throughout the leaching period. Further leaching will be required to determine the likely extend of this control.

The cumulative amount of SO_4 released from the leach columns is shown on Figure 10. Sulphate leached from the coal reject materials is low compared to the total potential SO_4 contained within the materials. Currently only 7 % of the total potential SO_4 in the beach deposited material has been leached, 9 % of that in the deposited slimes and only 5 % from the DMB rejects. Based on these figures it is likely that SO_4 release at the reported rates would be likely to continue into the long-term under field conditions.

The presented plots are showing a continued downward trend in SO_4 release and therefore a range of predicted SO_4 release rates have been reported. Further leaching is required to confirm the predicted long-term steady-state rate of SO_4 release from these materials.

The CO_3/SO_4 molar ratios plotted over time are shown on Figure 11. These ratios are used to indicate the balance between SO_4 release, from sulphide oxidation, and CO_3 consumption, from acid neutralisation reactions. Ratios of 0.8 to 1.0 indicate a balance

between SO_4 release and CO_3 consumption with no preferential leaching of CO_3. Ratios below this indicate that SO_4 release exceeds CO_3 consumption, while those above indicate that CO_3 is being preferentially leached over SO_4. The CO_3/SO_4 ratios for the DMB rejects range from about 0.3 to 0.6 indicating that SO_4 release continues to exceed CO_3 consumption. It is likely that these conditions will continue into the long-term. Ratio values of 0.7 to 1.0 for the beach deposited and slimes samples (apart from weeks 16 & 20 for the slimes) indicate a balance between SO_4 release and CO_3 consumption with no preferential leaching of CO_3. Further leaching is required to determine if carbonate buffering is likely to maintain this balance into the long-term.

These SO_4 release rates have been used to calculate the inherent oxidation rates (i.e. oxygen consumption rates, OCR) for each material type as follows:

Deposited slimes:	5×10^{-8} kg $O_2/m^3/sec$
DMB rejects:	2×10^{-8} kg $O_2/m^3/sec$
Beach Deposits:	1×10^{-7} kg $O_2/m^3/sec$
Treated Beach Deposits:	3×10^{-8} kg $O_2/m^3/sec$

The OCR's are typical of low to moderately reactive mine waste materials. The data also indicate that limestone treatment not only controls pH, but also results in a reduction in the oxidation rate by almost an order of magnitude.

Using the intrinsic oxidation rate (IOR) model, an assessment of the acid SO_4 generation rate from these materials can be made. Assuming a volumetric moisture content of less than 20% (i.e. 0.2 m^3/m^3) on exposed beaches, the beach deposits have the potential to generate approximately 150 tonnes of acid SO_4 per hectare per year. This rate is significant and indicates a high risk of acid generation problems for this material. Although the deposited slimes and DMB rejects are NAF, these materials could generate in the range of 70 to 100 tonnes of neutral SO_4 per hectare per year.

4.0 Implications for Coal Reject Disposal

Geochemical investigations carried out on the coal reject samples to-date indicate that:

- The DMB reject and co-disposed coarse reject and tailings, contain significant reactive sulphides and acid neutralising carbonates. Therefore, these materials will be reactive when exposed to surficial oxidation processes. The DMB rejects and co-disposed slimes are likely to contain sufficient available carbonates to neutralise acid generated through sulphide oxidation and therefore these materials are not likely to develop acid conditions. However, due to the higher reactive sulphide content and lack of available carbonates in the co-disposed beach deposits, it is likely that acid conditions will develop in these materials when left exposed. Reaction kinetics indicate that acid conditions are likely to develop in a relatively short time-frame (3 to 6 months) following exposure.

- Due to the presence of significant reactive sulphides in the coal reject materials, the release of SO_4 salts following exposure is a potential environmental concern. The rate of SO_4 release is a function of the reactive sulphide content. The following release rates for the different reject types have been predicted from the test results available to-date:

Coal Reject Type	*Predicted SO_4 release (t SO_4/ha/year)*
DMB rejects	110
Co-disposed slimes	180
Co-disposed beach deposits (untreated)	250
Co-disposed beach deposits (treated @ 10 kg lst./t)	140*

* The predicted rate of SO_4 release from the treated beach deposit material only applies to the SO_4 release control period. This period is yet to be determined from the leach columns.

Sulphate release from these materials when left exposed is expected to continue at the predicted rates into the long-term.

- Limestone treatment of the co-disposed beach deposited material at a rate of 10 kg/t is likely maintain pH control (pH above about 4) for a period of about 6 months and will also reduce the sulphate release rate (SRR). Once pH control is lost it is expected that SO_4 release will increase to a rate similar to that of the untreated material.

It is understood that the preferred option for coal reject disposal is to continue truck dumping the DMB rejects within the spoil dumps and to expand the co-disposal facility to the west to allow continued disposal of course reject and tailings.

These investigations have highlighted the potential risk of acid generation and high SO_4 release from exposed beaches along the perimeter of the co-disposal facility. Low pH conditions are likely to be developed in these materials within a short time-frame (3 to 6 months) following direct exposure oxidation (i.e. cessation of deposition). Limestone treatment should provide the necessary security to extend the period of exposure. However, long-term security will require some form of cover to reduce the oxygen flux into the deposited materials.

For operational pH and SO_4 release control, limestone can either be blended into the co-disposal material prior to disposal or incorporated into the beach deposited materials. Based on the test results available to-date, blending prior to disposal will require at least 10 kg/t (crushed limestone) to ensure operational control for a period of 6 months. Alternatively, limestone (crushed -2mm) could be incorporated into the upper 25 cm of the beach deposited material at a rate of about 5 kg/ha to provide the required control. Limestone application at higher rates would extend the control period and this aspect should be further assessed if limestone application is likely to be used as a treatment option.

5.0 Recommendations for Future Testing

It is recommended that all leach columns are operated for an additional 6 months to monitor pH, SO_4 release and CO_3 consumption. The analytical parameters should include pH, EC, acidity/alkalinity, Ca, Mg and SO_4. These results will allow refinement of predicted operational and long-term seepage water pH and SO_4 release.

Additional leach columns would have to be commissioned to further investigate the effect of higher limestone application rates on pH and SO_4 release control periods. It is recommended that this test work only be carried-out if limestone application for operational control is recognised as a viable treatment option.

Table 1: Acid forming characteristics and sulphur forms of selected coal reject samples from the Stratford Coal Mine.

Material Type	Sample Code	ACID-BASE ANALYSIS						NAG TEST	
		Total S	Pyritic S	SO4 S	Total ANC	Effective ANC	NAPP*	NAG	Final pH
		(%S)			(kg H2SO4/t)				
DMB-Rejects	DMB Comp	0.24	0.24	<0.01	17	10	-3	0	6.0
Co-Disposed Beach Deposit	CDB2	0.83	0.62	0.21	32	12	7	8	2.9
Co-Disposed Slimes	CDS1	0.68	0.64	0.04	15	16	4	0	5.5

NB: Repeat NAG tests indicate that the Co-Disposed Beach Deposit sample used for Stage 2 testing has a NAG capacity of 8 kg H2SO4/t which exceeds that of 1 kg H2SO4/t which was previously reported.

*NAPP values have been calculated from pyritic sulphur contents and effective ANC values.

Table 2: Leachate chemistry results for the co-disposed beach deposit leach column (sample CDB2), Stratford Coal Mine.

GEOCHEMICAL CHARACTERISTICS			
Total S (%S)	0.83	NAPP* (kg H2SO4/t)	7
Pyritic S (%S)	0.62		
Total ANC (kg H2SO4/t)	32	NAG (kg H2SO4/t)	8
Effective ANC (kg H2SO4/t)	12	NAG pH	2.9

*NAPP calculated using pyritic S and effective ANC

	CONCENTRATION IN SOLUTION (mg/L except pH &EC)					
WEEK NUMBER	4	8	12	16	20	24
COLLECTION NO.	1	2	3	4	5	6
Volume Leached (ml)	415	483	477	470	462	467
pH	6.9	6.2	7.3	6.3	3.9	3.5
EC (dS/m)	2.21	2.38	2.08	1.97	2.41	2.61
Alkalinity	30	-	19	10	-	-
Acidity (mgCaCO3/l)	-	5	-	-	16.0	18.0
Dissolved Constituents:						
Ca	235	225	275	290	300	285
Fe	2.3	3.3	0.01	<0.01	0.48	0.94
K	5.0	3.7	4.6	29.5	4.5	3.9
Mg	86	78	90	90	100	102
Na	205	170	185	145	140	98
SO4	1250	1140	1348	1258.2	1258.2	1198.3
Calculated Results						
Sulphate Release						
SO_4 Release Rate (mg/kg/wk)	-	69	80	74	73	70
Cumulative SO_4 Released (mg/kg)	259	534	855	1150	1441	1720
Residual Sulphur (%S)	0.82	0.81	0.80	0.79	0.78	0.77
Carbonate Consumption						
#Empirical CO_3 Consumption Rate (mg/kg/wk)	-	82	95	96	102	102
Cumulative CO_3 Consumed (mg/kg)	303	629	1010	1395	1802	2210
Residual Total ANC (kg H_2SO_4/t)	32	31	31	31	30	30
CO_3/SO_4 molar ratio	0.72	0.74	0.75	0.84	0.89	0.91

Emprical consumption rate assumes all Ca and Mg derived from dissolution of carbonates

Table 3: Leachate chemistry results for the limestone blended co-disposed beach deposit leach column (sample CDB2 +10 kg CaCO3/t) , Stratford Coal Mine.

GEOCHEMICAL CHARACTERISTICS			
Total S (%S)	0.83	NAPP* (kg H2SO4/t)	-
Pyritic S (%S)	0.62		
ANC (kg H2SO4/t)	-	NAG (kg H2SO4/t)	3
Effective ANC (kg H2SO4/t)	-	NAG pH	3.5

*NAPP calculated using pyritic S and effective ANC

	CONCENTRATION IN SOLUTION (mg/L except pH &EC)					
WEEK NUMBER	4	8	12	16	20	24
COLLECTION NO.	1	2	3	4	5	6
Volume Leached (ml)	431	493	509	493	480	482
pH	7.5	6.96	7.5	7.2	7.1	6.2
EC (dS/m)	1.21	0.903	1.42	1.09	1.05	1.06
Alkalinity /	31.2	17	30	17	18	-
Acidity	-	-	-	-	-	5
(mgCaCO3/l)						
Dissolved Constituents:						
Ca	92	72	130	98	96	70
Fe	0.05	<0.01	0.01	<0.01	<0.01	<0.01
K	3.3	1.9	3.8	4.2	2.7	1.7
Mg	36	28.5	58	49	41	29
Na	110	66	140	88	70	48
SO4	520	340	749	554.2	464.3	389.4
Calculated Results						
Sulphate Release						
SO_4 Release Rate (mg/kg/wk)	-	21	48	34	28	23
Cumulative SO_4 Released (mg/kg)	112	196	386	523	634	728
Residual Sulphur (%S)	0.83	0.82	0.82	0.81	0.81	0.81
Carbonate Consumption						
#Empirical CO_3 Consumption Rate (mg/kg/wk)	-	29	58	46	39	28
Cumulative CO_3 Consumed (mg/kg)	128	244	476	659	816	929
Residual Total ANC (kg H_2SO_4/t)	-	-	-	-	-	-
CO_3/SO_4 molar ratio	0.70	0.84	0.72	0.77	0.84	0.73

Emprical consumption rate assumes all Ca and Mg derived from dissolution of carbonates

Table 4: Leachate chemistry results for the co-disposed slimes leach column (sample CDS1), Stratford Coal Mine.

GEOCHEMICAL CHARACTERISTICS			
Total S (%S)	0.68	NAPP* (kg H2SO4/t)	4
Pyritic S (%S)	0.64		
ANC (kg H2SO4/t)	15	NAG (kg H2SO4/t)	0
Effective ANC (kg H2SO4/t)	16	NAG pH	5.5

*NAPP calculated using pyritic S and effective ANC

WEEK NUMBER	CONCENTRATION IN SOLUTION (mg/L except pH &EC)						
	0	4	8	12	16	20	24
COLLECTION NO.	Initial	1	2	3	4	5	6
Volume Leached (ml)	467	445	402	411	410	411	396
pH	8.3	7.4	8.86	7.5	7.4	7.0	6.9
EC (dS/m)	4.81	3.31	2.38	2.47	1.81	1.72	1.36
Alkalinity /	123	33	31	43	26	35	25
Acidity	-	-	-	-	-	-	-
(mgCaCO3/l)							
Dissolved Constituents:							
Ca	490	350	310	300	180	230	180
Fe	<0.01	<0.01	0.1	0.01	<0.01	<0.01	0.05
K	10	21.5	5.4	5.4	2.6	3.6	2.6
Mg	205	135	100	104	50	72	50
Na	660	370	220	170	80	106	62
SO4	2250	1900	1557.8	1198.3	554.2	808.8	689
Calculated Results							
Sulphate Release							
SO_4 Release Rate (mg/kg/wk)	-	105	78	61	28	41	34
Cumulative SO_4 Released (mg/kg)	524	945	1257	1503	1616	1782	1918
Residual Sulphur (%S)	0.66	0.65	0.64	0.63	0.63	0.62	0.62
Carbonate Consumption							
#Empirical CO_3 Consumption Rate (mg/kg/wk)	-	124	90	93	49	67	47
Cumulative CO_3 Consumed (mg/kg)	770	1268	1626	1997	2192	2460	2649
Residual Total ANC (kg H_2SO_4/t)	14	14	13	13	13	13	12
CO_3/SO_4 molar ratio	0.88	0.72	0.73	0.94	1.14	1.03	0.91

Emprical consumption rate assumes all Ca and Mg derived from dissolution of carbonates

Table 5: Leachate chemistry results for the DMB rejects leach column (sample DMB Comp), Stratford Coal Mine.

GEOCHEMICAL CHARACTERISTICS			
Total S (%S)	0.24	NAPP* (kg H2SO4/t)	-3
Pyritic S (%S)	0.24		
ANC (kg H2SO4/t)	17	NAG (kg H2SO4/t)	0
Effective ANC (kg H2SO4/t)	10	NAG pH	6.0

*NAPP calculated using pyritic S and effective ANC

WEEK NUMBER	CONCENTRATION IN SOLUTION (mg/L except pH &EC)					
	4	8	12	16	20	24
COLLECTION NO.	1	2	3	4	5	6
Volume Leached (ml)	367	423	439	442	432	445
pH	7.8	7.51	8.0	7.8	8.0	8.2
EC (dS/m)	1.05	1.46	1.48	1.06	1.18	1.11
Alkalinity / Acidity (mgCaCO3/l)	34 -	30 -	55 -	63 -	123 -	100 -
Dissolved Constituents:						
Ca	19	26.5	39	25.5	28.5	19
Fe	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
K	3.0	3.2	3.7	2.8	2.8	1.8
Mg	13	20	29	19	21	13.5
Na	170	200	250	175	180	135
SO4	265	380	494.3	281.6	239.6	161.7
Calculated Results						
Sulphate Release						
SO_4 Release Rate (mg/kg/wk)	-	20	27	16	13	9
Cumulative SO_4 Released (mg/kg)	49	129	238	300	352	388
Residual Sulphur (%S)	0.24	0.24	0.23	0.23	0.23	0.23
Carbonate Consumption						
#Empirical CO_3 Consumption Rate (mg/kg/wk)	-	14	22	14	15	10
Cumulative CO_3 Consumed (mg/kg)	32	89	175	232	293	334
Residual Total ANC (kg H_2SO_4/t)	17	17	17	17	17	17
CO_3/SO_4 molar ratio	0.35	0.38	0.42	0.48	0.63	0.61

Emprical consumption rate assumes all Ca and Mg derived from dissolution of carbonates

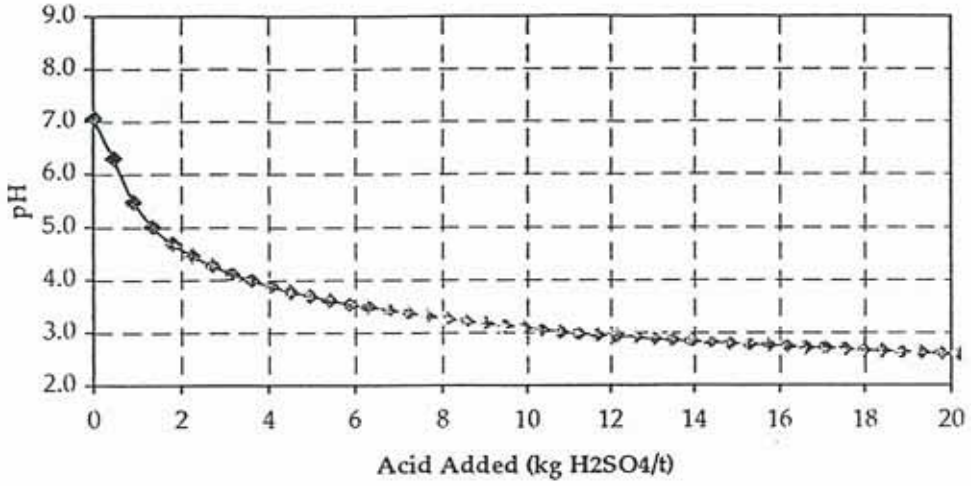


Figure 1: Acid buffering characteristic curve for DMB Rejects Composite sample (DMB2 & DMB 3) with a calculated ANC of 17 kg H2SO4/t.

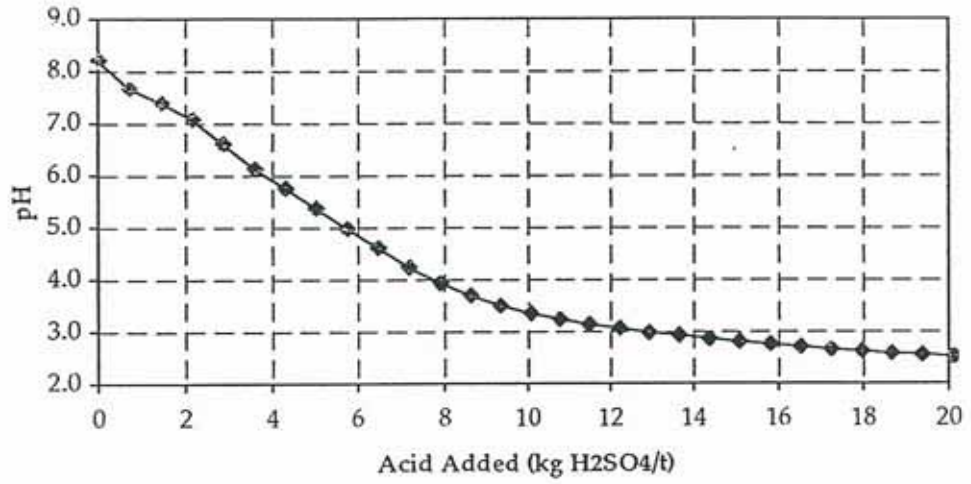


Figure 2: Acid buffering characteristic curve for Co-Disposed Beach Deposit sample CDB2 with a measured ANC of 32 kg H2SO4/t.

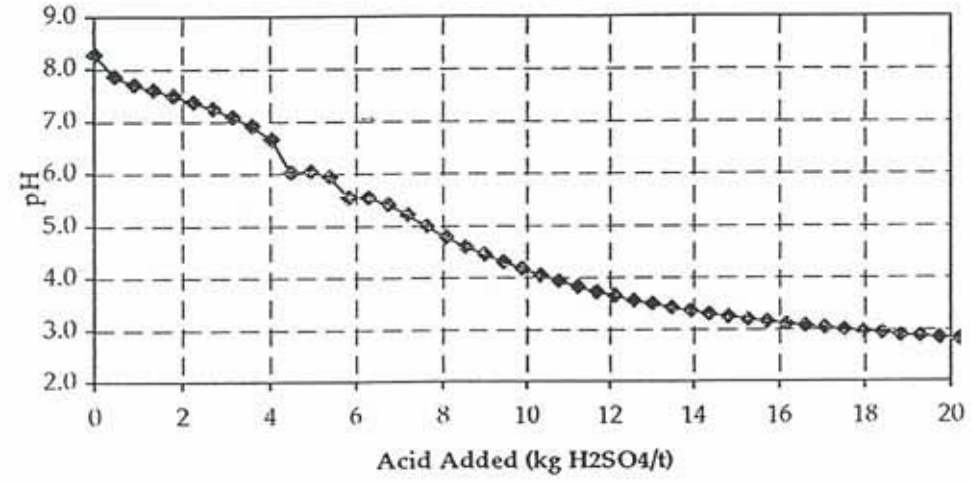
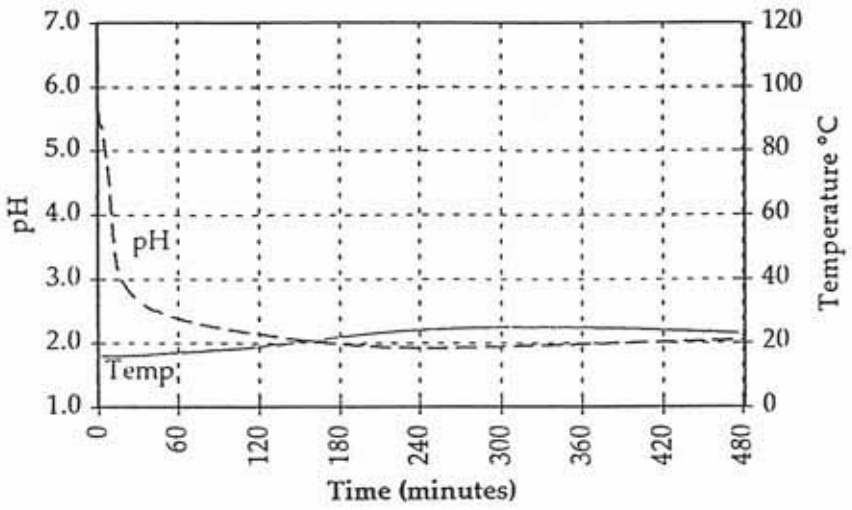


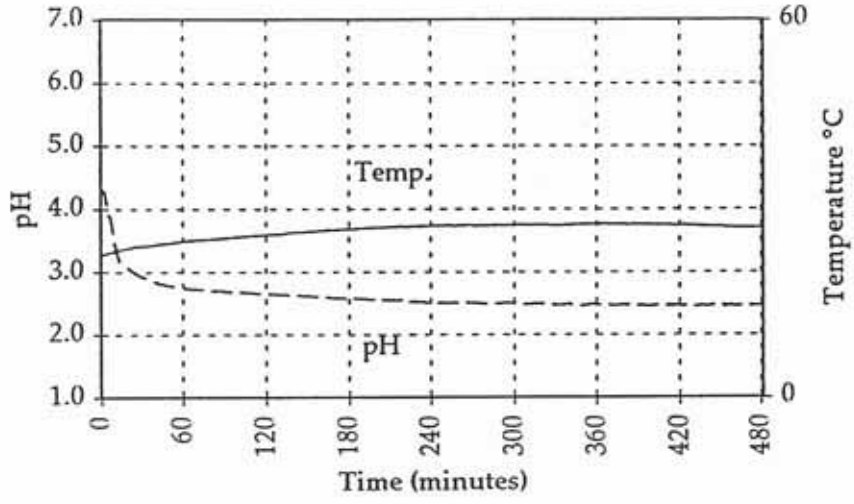
Figure 3: Acid buffering characteristic curve for Co-Disposed Slimes sample CDS1 with a measured ANC of 15 kg H2SO4/t.



Total S = 0.83 %S
Pyritic S = 0.62%S
Total ANC = 32 kg H2SO4/t
Effective ANC = 12 kg H2SO4/t
NAPP* = 7 kg H2SO4/t
NAGpH = 2.9
NAG = 8 kg H2SO4/t

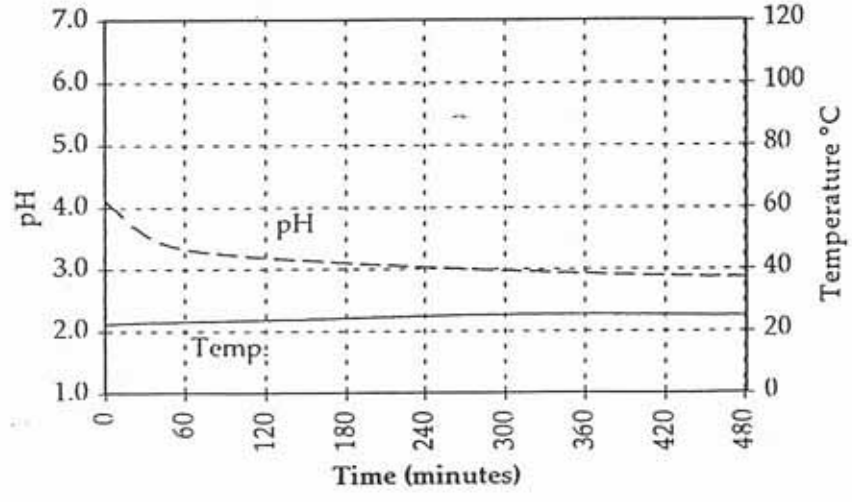
*NAPP calculated from pyritic S and effective ANC

Figure 4: Kinetic NAG profile for the untreated Co-Disposed Beach Deposit sample CDB-2.



NAGpH = 3.0
NAG = 6 kg H2SO4/t

Figure 5: Kinetic NAG profile for the Co-Disposed Beach Deposit sample CDB-2 treated with 5 kg CaCO3 (pulverised limestone) per tonne.



NAGpH = 3.5
NAG = 3 kg H2SO4/t

Figure 6: Kinetic NAG profile for the Co-Disposed Beach Deposit sample CDB-2 treated with 10 kg CaCO3 (pulverised limestone) per tonne.

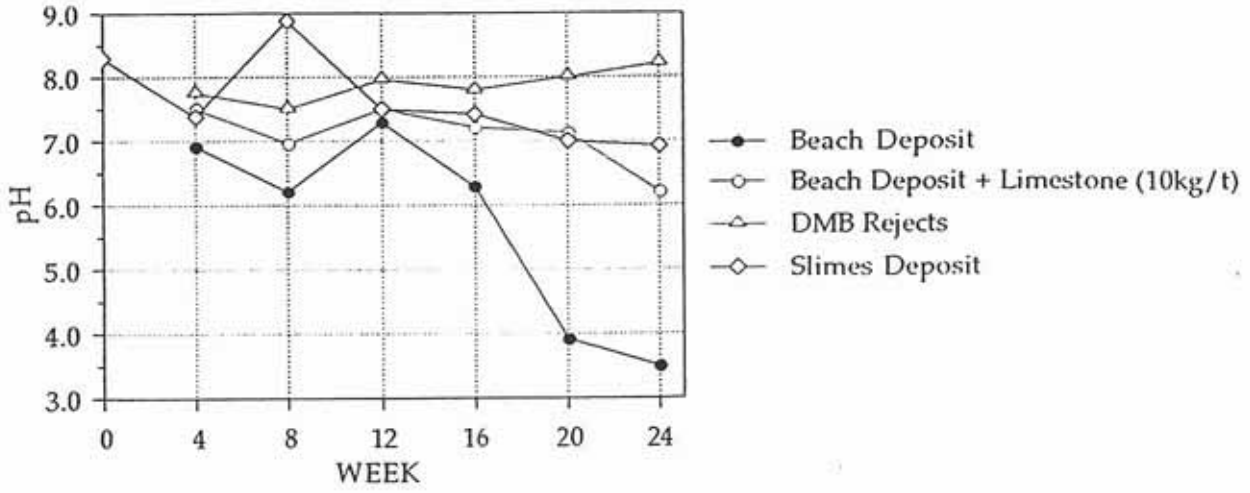


Figure 7: pH trend with leaching.

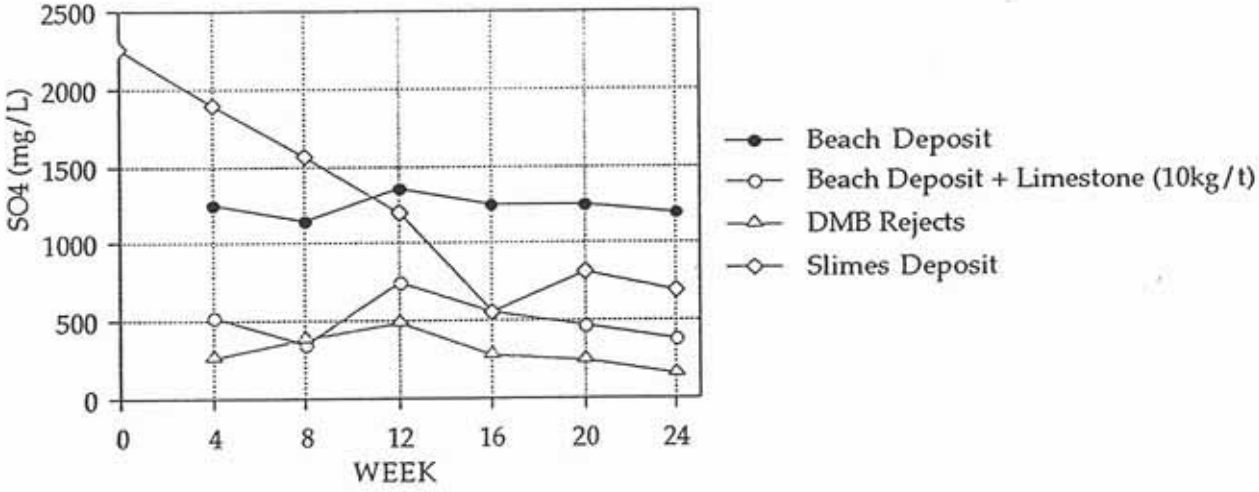


Figure 8: Sulphate concentration trend with leaching.

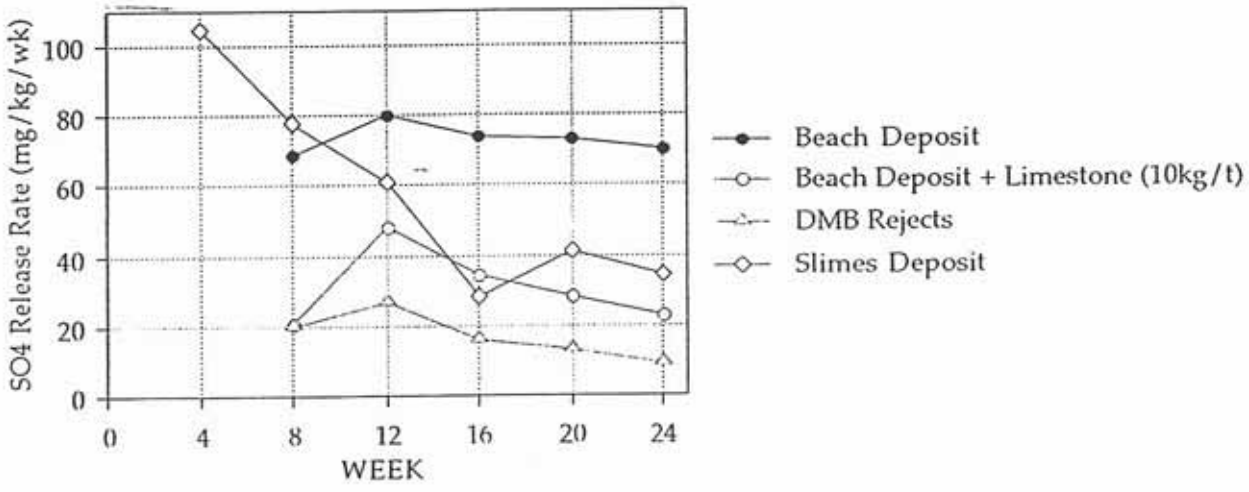


Figure 9: Sulphate release rate trend with leaching.

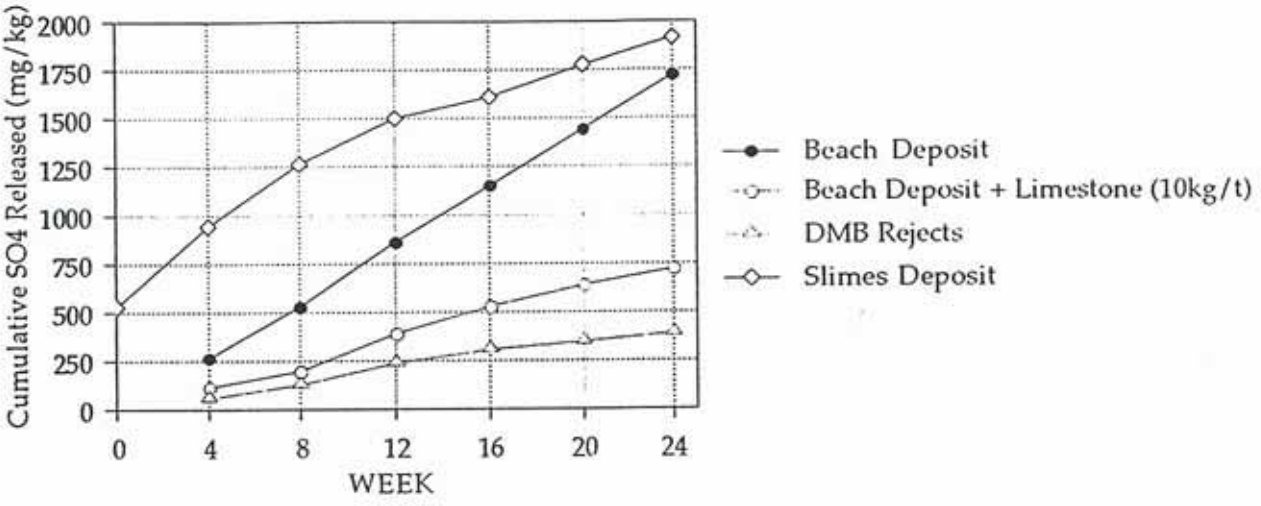


Figure 10: Cumulative SO4 release with leaching.

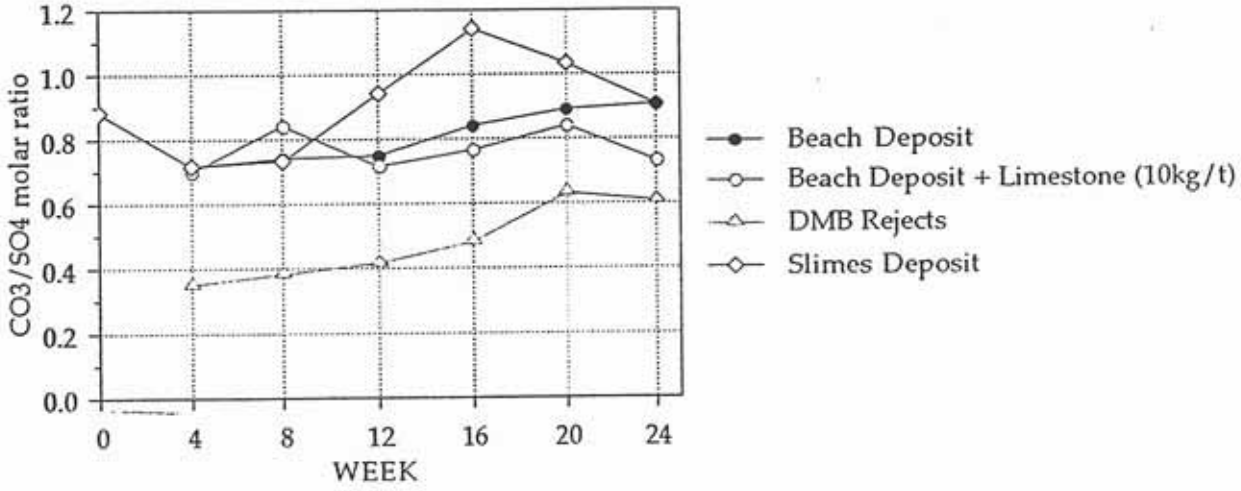


Figure 11: CO3/SO4 molar ratio trend with leaching.

APPENDIX A

Leach Column Design and Operation

Leach Column Design and Operation for Environmental Geochemical Investigations (Free Draining Leach Columns)

Column Design

The free draining column configuration is shown in Figure A1. The internal dimensions of the column funnels are approximately 175 mm diameter and 100 mm high, giving a capacity of about 2.5 litres. Typically, they will hold about 2 to 2.5 kg of sample. The dry weight of sample in each column is determined prior to commencing leaching.

Leach Column Operation

The operation of the leach columns is designed to achieve a weekly wet-dry cycle and a monthly leaching cycle. The sample is wetted by applying water to the surface of the column each Friday and heat lamps are used to ensure drying of the sample. Leachates are usually collected every 4th Monday, however this is sometimes modified depending on material characteristics and analytical requirements.

Heat Lamp Operation

- Heat lamps are operated during work hours from Monday to Friday.
- The lamps maintain a temperature of 30 to 35 °C on the surface of the columns.
- The lamps are switched off at least 3 hours prior to water application to reduce surface evaporation effects.
- The lamps are switched on after leachates have been collected.

Water Application

- Deionised water is applied to the surface of the columns every Friday afternoon according to the schedule shown below:

Week of Monthly Cycle	*Water Application*	
	Rate (per kg sample)	*Total Volume (2kg sample)*
1	100 mL	200 mL
2	100 mL	200 mL
3	100 mL	200 mL
4	400 mL	800 mL

Leachate Collection

- Leachates are collected on every 4th Monday morning.

Leachate Analysis

- Routine leachate analyses carried out by EGi include; pH, EC and Alkalinity / Acidity.
- The solutions are then filtered (< 0.45 μm) and acidified to pH < 2 prior to elemental scans being performed.

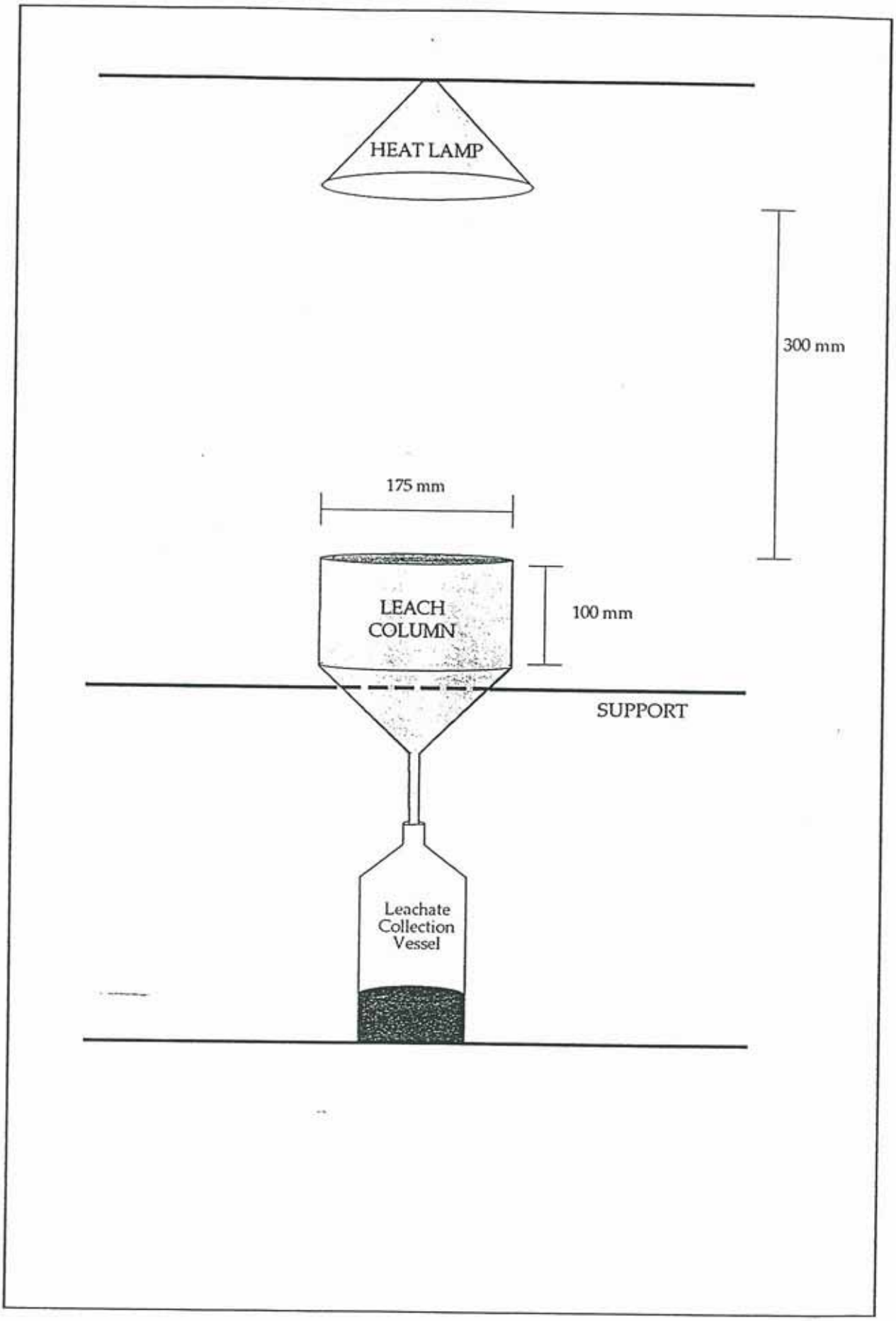


Figure A1: Schematic diagram of leach column set-up.

APPENDIX B

Rejects Physical Testwork Results

PPK
Environment&Infrastructure

PPK Environment & Infrastructure Pty Ltd
100 George Street
Singleton NSW 2330
PO Box 115 Singleton
NSW 2330 Australia
Telephone 065 723 377
Facsimile 065 724 080

ACN 078 004 798
A NATA Certified Quality Company

Our Reference:J:\63K057A\LT001APK.DOC

22 July, 1998

Mr John Trotter
Stratford Coal
Post Office Box 168
GLOUCESTER NSW 2422

Dear John

Re: Washery Rejects Co-Disposal Geotechnical Assessment

1. Introduction

At your request we have undertaken a limited geotechnical assessment and testing of co-disposal washery reject at Stratford Coal. The aim of this investigation was to provide geotechnical log profiles of exposed material in the co-disposal area and collect representative samples for additional testing by PPK and others, as outlined in your scope of works dated 29 May 1998.

The fieldwork for this investigation was undertaken on 12 June 1998.

2. Fieldwork

The investigation area was located on the rejects co-disposal area to the north northeast of Stratford Coal Administration Building. Four testpits were excavated using a backhoe and located by Stratford Coal personnel. Three test pits were located within the "dry beach" area and the fourth located within the "slimes pond".

These locations were pegged for survey purposes, to be located on a site plan by Stratford Coal. Recovered materials were logged by an experienced Geotechnical Engineer and representative samples were taken for subsequent testing. Detailed Geotechnical logs have been attached to this report with explanatory notes on geotechnical terms used.

Field dry density tests (AS 1289 5.3.1 Sand Replacement Method) were undertaken in each testpit within the "dry beach" area at a depth of 1.0 m.

Generally, the profile encountered comprised loose to very loosely compacted silty sandy gravel, black/grey (reject co-disposal).

3. Results

Soil tests conducted were performed in accordance with the methods in AS 1289 Methods of Testing of Soils for Engineering Purposes. The results have been summarised below:

Source	Depth (m)	Field Dry Density t/m^3	Field Moisture Content (%)	Specific Gravity
TP1	1.0	1.140	10.0	1.62
TP2	1.0	1.303	12.5	1.60
TP3	1.0	1.262	13.0	1.78
TP4	1.0	NT*	71.4	2.06

NT* Not Tested

Test reports for full particle size distribution have been attached.

PPK will retain recovered samples for a period of three months if additional testing is required.

Should you require clarification or further information please contact Peter Kube or the undersigned.

Yours sincerely

Damian Wilson
Geotechnical Engineer
PPK Environment & Infrastructure Pty Ltd

Attached:
1. Test Pit Logs
2. Explanatory Notes
3. Test Reports

PPK Environment & Infrastructure Pty Ltd

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Test Pit No.:

TP1

PROFILE - ENGINEERING LOG

Sheet 1 of 1

Client : STRATFORD COAL PTY LTD

Project : CO-DISPOSAL TESTING

Job number : 63K057A

Date: 12th June 1998

Supervised by : PK

Log checked by : DW

Test Location See Site Plan

Northing: Easting

Surface R.L.:

Height Datum:

Excavation Method : Backhoe

Drilling Information				Sampling		Geotechnical Description
	Water	R.L.	Depth metres	Samples	Graphic Log	SOIL TYPE, colour, consistency/relative density, moisture, structure, (origin), USC ROCK TYPE, colour, texture, structure, weathering/ alteration, strength, defects, etc.
	No Groundwater Encountered		0.5 1.0 1.5 2.0 2.5	Representative bulk sample		Silty, sandy GRAVEL, black/grey (CARBONACEOUS SILTSTONE/COAL,) coarse gravel from 50mm Co-diposal washery reject. Fine Gravel with occasional coarse gravel, becoming finer with depth
			3.0 3.5 4.0 4.5 5.0			Testpit Terminated at 2.5 metres No refusal to Backhoe

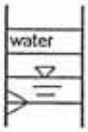
Consistency/ Rel. Density: Fb VL L M D VD | VS S F St VSt H

Moisture: Dry Moist Wet Saturated

Dynamic Cone Penetrometer Blows/100mm: 2 4 6 8 10 15 20

Water

water level date or time shown



.../.../....

water inflow

Sampling Data

U50 undisturbed sample 50mm diameter

D disturbed sample

NC cone penetrometer

Moisture

D Dry
M Moist
W Wet
S Saturated

Consistency/Relative Density

VS very soft
S soft
F firm
St stiff
VSt very stiff
H hard

Fb friable
VL very loose
L loose
M medium dense
D dense
VD very dense

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Test Pit No.:

TP2

PROFILE - ENGINEERING LOG

Sheet 1 of 1

Client : STRATFORD COAL PTY LTD

Project : CO-DISPOSAL TESTING

Job number : 63K057A

Date: 12th June 1998

Supervised by : PK

Log checked by : DW

Test Location See Site Plan

Northing: Easting

Surface R.L.:

Height Datum:

Excavation Method : Backhoe

Drilling Information				Sampling		Geotechnical Description	Consistency/ Rel. Density	Moisture	Dynamic Cone Penetrometer Blows/100mm
	Water	R.L.	Depth metres	Samples	Graphic Log	SOIL TYPE, colour, consistency/relative density, moisture, structure, (origin), USC ROCK TYPE, colour, texture, structure, weathering/ alteration, strength, defects, etc.	VS S F St VSt H / Fb VL L M D VD	Dry Moist Wet Saturated	2 4 6 8 10 15 20
	perched water		0.5 1.0 1.5 2.0 2.5	Representative bulk sample		Silty, sandy GRAVEL, black/grey (CARBONACEOUS SILTSTONE/COAL,) coarse gravel from 50mm Co-diposal washery reject. Fine Gravel with occasional coarse gravel, becoming finer with depth			
			3.0 3.5 4.0 4.5 5.0			Testpit Terminated at 2.5 metres No refusal to Backhoe			

Water

water level date or time shown

.../.../....

water inflow

Sampling Data

U50 undisturbed sample 50mm diameter

D disturbed sample

NC cone penetrometer

Moisture

D Dry
M Moist
W Wet
S Saturated

Consistency/Relative Density

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
M	medium dense
D	dense
VD	very dense

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Test Pit No.:

TP3

PROFILE - ENGINEERING LOG

Sheet 1 of 1

Client :	STRATFORD COAL PTY LTD	Job number :	63K057A
Project :	CO-DISPOSAL TESTING	Date:	12th June 1998
		Supervised by :	PK
		Log checked by :	DW
Test Location	See Site Plan	Surface R.L.:	Excavation Method : Backhoe
Northing:	Easting	Height Datum:	

Drilling Information: Water	R.L.	Depth metres	Sampling: Samples	Graphic Log	Geotechnical Description: SOIL TYPE, colour, consistency/relative density, moisture, structure, (origin), USC; ROCK TYPE, colour, texture, structure, weathering/ alteration, strength, defects, etc	Consistency/ Rel. Density (VS S F St VSt H / Fb VL L M D VD)	Moisture (Dry Moist Wet Saturated)	Dynamic Cone Penetrometer Blows/100mm (2 4 6 8 10 15 20)
No Groundwater Encountered		0.0 – 2.5	Representative bulk sample (0.5 – 2.5)		Silty, sandy GRAVEL, black/grey (CARBONACEOUS SILTSTONE/COAL,) coarse gravel from 50mm Co-diposal washery reject. Some grey brown gravel (SILTSTONE) Fine Gravel with occasional coarse gravel, becoming finer with depth	F	Moist	
		2.5			Testpit Terminated at 2.5 metres No refusal to Backhoe			

Depth scale: 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0

Water

water level date or time shown ..../..../....

water inflow

Sampling Data

U50 undisturbed sample 50mm diameter

D disturbed sample

NC cone penetrometer

Moisture

D Dry
M Moist
W Wet
S Saturated

Consistency/Relative Density

VS very soft
S soft
F firm
St stiff
VSt very stiff
H hard

Fb friable
VL very loose
L loose
M medium dense
D dense
VD very dense

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Test Pit No.:

TP4

PROFILE - ENGINEERING LOG

Sheet 1 of 1

Client : STRATFORD COAL PTY LTD

Project : CO-DISPOSAL TESTING

Job number : 63K057A

Date: 12th June 1998

Supervised by : PK

Log checked by : DW

Test Location See Site Plan

Northing: Easting

Surface R.L.:

Height Datum:

Excavation Method : Backhoe

Drilling Information				Sampling		Geotechnical Description	Consistency/ Rel. Density							Moisture				Dynamic Cone Penetrometer Blows/100mm						
	Water	R.L.	Depth metres	Samples	Graphic Log	SOIL TYPE, colour, consistency/relative density, moisture, structure, (origin), USC ROCK TYPE, colour, texture, structure, weathering/ alteration, strength, defects, etc.	VS	S	F	St	VSt	H	Fb	VL	L	M	D	VD	Dry	Moist	Wet	Saturated	2	4	6	8	10	15	20
	WATER		0.5 1.0 1.5 2.0 2.5			SILT, black saturated (COAL TAILINGS)																						
			3.0 3.5 4.0 4.5 5.0			Testpit Terminated at 2.5 metres																						

Water

water level date or time shown

water

..../..../....

water inflow

Sampling Data

U50 undisturbed sample 50mm diameter

D disturbed sample

NC cone penetrometer

Moisture

D Dry
M Moist
W Wet
S Saturated

Consistency/Relative Density

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
M	medium dense
D	dense
VD	very dense

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Explanatory Notes to Accompany Investigation Logs

Soil Description

The dominant soil constituent is given in capital letters, with secondary textures in lower case. The dominant feature is determined from the Unified Soil Classification system and a soil symbol is used to define a soil layer as follows:

UNIFIED SOIL CLASSIFICATION

The appropriate symbols are selected on the result of visual examination, field tests and available laboratory tests, such as, sieve analysis, liquid limit and plasticity index.

USC Symbol	Description
GW	Well graded gravel
GP	Poorly graded gravel
GM	Silty gravel
GC	Clayey gravel
SW	Well graded sand
SP	Poorly graded sand
SM	Silty sand
SC	Clayey sand
ML	Silt of low plasticity
CL	Clay of low plasticity
OL	Organic soil of low plasticity
MH	Silt of high plasticity
CH	Clay of high plasticity
OH	Organic soil of high plasticity
Pt	Peaty Soil

MOISTURE CONDITION

Dry - Cohesive soils are friable or powdery
Cohesionless soil grains are free-running

Moist - Soil feels cool, darkened in colour
Cohesive soils can be moulded
Cohesionless soil grains tend to adhere

Wet - Cohesive soils usually weakened
Free water forms on hands when handling

For cohesive soils the following code may also be used:

MC >>PL	Moisture Content much greater than the Plastic Limit.
MC > PL	Moisture Content greater than the Plastic Limit.
MC ~ PL	Moisture Content near the Plastic Limit.
MC < PL	Moisture Content less than the Plastic Limit.
MC << PL	Moisture Content much less than Plastic Limit.

PLASTICITY

The potential for soil to undergo change in volume with moisture change is assessed from its degree of plasticity. The classification of the degree of plasticity in terms of the Liquid Limit (LL) is as follows:

Description of Plasticity	LL (%)
Low	<35
Medium	35 to 50
High	>50

COHESIVE SOILS - CONSISTENCY

The consistency of a cohesive soil is defined by descriptive terminology such as very soft, soft, firm, stiff, very stiff and hard. These terms are fixed by the shear strength of the soil as observed visually, by the pocket penetrometer values and by resistance to deformation to hand moulding.

A Pocket Penetrometer may be used in the field or the laboratory to provide approximate determination of unconfined compressive strength of cohesive soils. The values are recorded in kPa, as follows:

Strength		Pocket Penetrometer Reading (kPa)
Very Soft	VS	< 25
Soft	S	20 to 50
Firm	F	50 to 100
Stiff	St	100 to 200
Very Stiff	VSt	200 to 400
Hard	H	> 400

COHESIONLESS SOILS - RELATIVE DENSITY

Relative density terms such as very loose, loose, medium, dense and very dense are used to describe silty and sandy material, and these are usually based on resistance to drilling penetration or the Standard Penetration Test (SPT) 'N' values. Other condition terms , such as friable, powdery or crumbly may also be used.

The Standard Penetration Test (SPT) is carried out in accordance with AS 1289, 6.3.1. For completed tests the number of blows required to drive the split spoon sampler 300 mm are recorded as the N value. For incomplete tests the number of blows and the penetration beyond the seating depth of 150 mm are recorded. If the 150 mm seating penetration is not achieved the number of blows to achieve the measured penetration is recorded.

		Density Index (%)	N Value
Very Loose	VL	0 to 15	0 to 4
Loose	L	15 to 35	4 to 10
Medium Dense	MD	35 to 65	10 to 30
Dense	D	65 to 85	30 to 50
Very Dense	VD	>85	>50

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Rock Description

The rock is described with strength and weathering symbols as shown below. Other features such as bedding and dip angle are given.

ROCK QUALITY

The fracture spacing is shown where applicable and the Rock Quality Designation is given where:

$$RQD\ (\%) = \frac{\text{sum of sound core pieces 100 mm or longer}}{\text{total length considered}}$$

ROCK STRENGTH

Rock strength is described using AS1726 and ISRM - Commission on Standardisation of Laboratory and Field Tests, "Suggested method of determining the Uniaxial Compressive Strength of Rock materials and the Point Load Index", as follows:

Point Load Index		$Is_{(50)}$ (MPa)
Extremely Low	EL	< 0.03
Very Low	VL	0.03 to 0.1
Low	L	0.1 to 0.3
Medium	M	0.3 to 1
High	H	1 to 3
Very High	VH	3 to 10
Extremely High	EH	> 10

ROCK WEATHERING

Rock weathering is described using the following abbreviation and definitions used in AS1726:

RS	Residual soil
XW	Extremely weathered
DW	Distinctly weathered
SW	Slightly weathered
FR	Fresh

DEFECT SPACING/BEDDING THICKNESS

Measured at right angles to defects of same set or bedding.

Defect		Bedding
Extremely closely spaced	<6 mm	Thinly Laminated
	6 to 20 mm	Laminated
Very closely spaced	20 to 60 mm	Very Thin
Closely spaced	0.06 to 0.2 m	Thin
Moderately widely spaced	0.2 to 0.6 m	Medium
Widely spaced	0.6 to 2 m	Thick
Very widely spaced	> 2 m	Very Thick

DEFECT DESCRIPTION

Type:

B	Bedding
F	Fault
C	Cleavage
J	Joint
S	Shear Zone
D	Drill break

Planarity / Roughness:

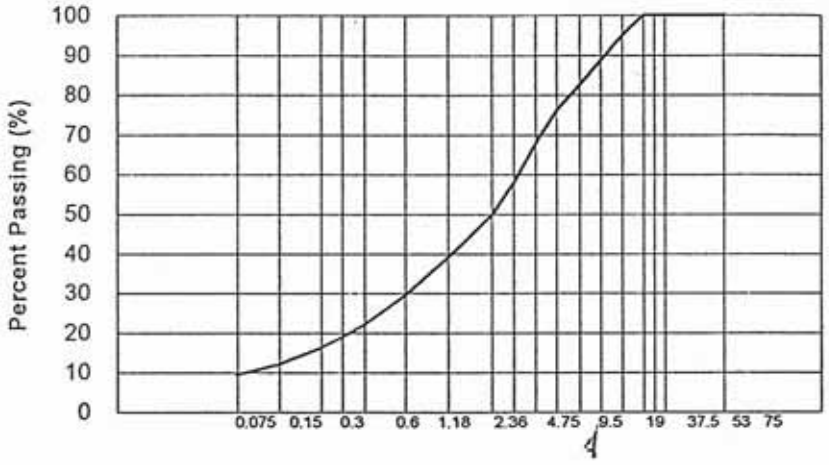
Class	Description
I	rough or irregular, stepped
II	smooth, stepped
III	slickensided, stepped
IV	rough or irregular, undulating
V	smooth, undulating
VI	slickensided, undulating
VII	rough or irregular, planar
VIII	smooth, planar
IX	slickensided, planar

Aggregates For Engineering Purposes

Client:	Stratford Coal	Job No.	63K057A
Project:	Co-Disposal	Sample No.	4518
Location:	Statford	Depth:	
Source:	TP1 0-2.5m	Report No.	1

Sieve Size (mm)	% Passing	Specification
200	100.0	
75	100.0	
63	100.0	
53	100.0	
37.5	95.0	
26.5	88.5	
19	82.5	
13.2	76.0	
9.5	67.5	
6.7	58.0	
4.75	49.5	
2.36	39.0	
1.18	29.5	
0.600	22.0	
0.425	19.0	
0.300	16.0	
0.150	12.0	
0.075	9.5	

Particle Size Distribution



Test	Result	Specification	
Average Least Dimension (m			
Fractured Faces (%)			
Material Finer than 75Fm (%)			

Material Description: Coal Rejects

Procedures Used: D,G,H,I

(A) RTA T201 (D) Oven Dried (G) Sampled By PPK Personnel

(B) RTA T235 (E) Dry Sieved (H) Sampled from Stockpile in accordance with AS1141.

(C) RTA T203 (F) Sampled By Client (I) AS 1289 Sieve to 75um

Comments

This laboratory is registered by the National Association of Testing Authorities, Australia. The tests reported herein have been performed in accordance with its terms of registration.

Authorised Signatory: Date: 30-6-98

PPK Environment & Infrastructure Pty Ltd
100 George Street
Singleton NSW 2330
Laboratory No.1731

PPK Environment & Infrastructure

Client:	STRATFORD COAL	Job No:	63K057A
Project:	MATERIAL EVALUATION	Report No:	B1
Location:	STRATFORD	Sample No:	4518

AGGREGATES FOR ENGINEERING PURPOSES-CONCRETE

TEST AS1141	METHOD RTA	DESCRIPTION	TEST RESULT	SPECIFICATION
		DIMENSIONAL REQUIREMENTS		
1141.11 ☐	T201 ☐	GRADING		
		75.0mm		
		53.0mm		
		37.5mm		
		26.5mm		
		19.0mm		
		13.2mm		
		9.5mm		
		6.7mm		
		4.75mm		
		2.36mm		
		1.18mm		
		0.600mm		
		0.300mm		
		0.150mm		
		0.075mm		
141.12 ☐	T203 ☐	MATERIAL FINER THAN 75um	%	max
141.14 ☐	T213 ☐	PARTICLE SHAPE 3:1 Ratio	%	max
141.20 ☐	T235 ☐	AVERAGE LEAST DIMENSION	mm	min
141.33 ☐	T268 ☐	CLAY & FINE SILT	%	max
		GENERAL REQUIREMENTS		
141.5/6 ☑	T209 ☐	PARTICLE DENSITY (SSD)	1620 kg/m3	min
	T210 ☐	PARTICLE DENSITY (DRY)	1460 kg/m3	min
		WATER ABSORPTION	11.2 %	max
141.4 ☐	T211 ☐	BULK DENSITY (Loose)	kg/m3	min
	T212 ☐	BULK DENSITY (Compacted)	kg/m3	min
		DURABILITY		
141.22 ☐	T215 ☐	WET DRY STRENGTH VARIATION	%	max
		WET STRENGTH	KN	min
		DRY STRENGTH	KN	min
		SIZE OF TEST PORTION		
.23 ☐	T204 ☐	LOS ANGELES VALUE	%	max
		TEST GRADING		
141.24 ☐	T266 ☐	SODIUM SULPHATE SOUNDNESS		
		LOSS ON EACH FRACTION		
		OVERALL WEIGHTED LOSS	%	max

EMARKS: TP1 0-2.5m.Coarse & fine material tested separately then averaged out.Submitted by PPK Singleton

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Authorised Signatory: T.N. Cahill

Date: 24-6-98

PPK Environment & Infrastructure

PPK Environment & Infrastructure Pty Ltd
59 Sydney Road.Bathurst.NSW.2795
Materials Laboratory No. 1281
Phone: (02) 63314188 Fax: (02)63316798

Aggregates For Engineering Purposes

Client:	Stratford Coal	Job No.	63K057A
Project:	Co-Disposal	Sample No.	4519
Location:	Stratford	Depth:	
Source:	TP2 0-2.5m	Report No.	2

Sieve Size (mm)	% Passing	Specification
200		
75		
63		
53	100	
37.5	94	
26.5	87	
19	79	
13.2	71	
9.5	63	
6.7	53	
4.75	45	
2.36	34	
1.18	21	
0.600	13	
0.425	10	
0.300	7	
0.150	4	
0.075	1.9	

ATTERBERG LIMITS			Procedures
Liquid Limit	%		
Plastic Limit	%		
Plasticity Index	%		
Linear Shrinkage	%		
Mould Length	mm		
Crumbling / Curling			
Sample History			H,K
Sample Preparation			F

(A) AS 1289.3.1 . 1 Liquid Limit - Standard Method
(B) AS 1289.3.1 . 2 Liquid Limit - Subsidiary Method
(C) AS 1289.3.2 . 1 Plastic Limit - Standard Method
(D) AS 1289.3.3 . 1 Plasticity Index - Standard Method
(E) AS 1289.3.4 . 1 Linear Shrinkage - Standard Method
(F) AS 1289.3.6 . 1 Washed
(G) AS 1289.3.6 . 2 Dry Sieved
(H) OVEN DRIED
(I) DRY SIEVED
(J) RTA T201
(K) Sampled By PPK Personnel
(L) Sampled By Client

SOILS DESCRIPTION / USC: Coal Rejects

Remarks:

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Authorised Signatory: M. Keogh Date: 30.6.98

PPK Environment & Infrastructure Pty Ltd
100 George Street
Singleton NSW 2330
Laboratory No.1731

Client:	STRATFORD COAL	**Job No:**	63K057A
Project:	MATERIAL EVALUATION	**Report No:**	B2
Location:	STRATFORD	**Sample No:**	4519

AGGREGATES FOR ENGINEERING PURPOSES-CONCRETE

TEST AS1141	METHOD RTA	DESCRIPTION	TEST RESULT	SPECIFICATION
		DIMENSIONAL REQUIREMENTS		
1141.11 ☐	T201 ☐	GRADING		
		75.0mm		
		53.0mm		
		37.5mm		
		26.5mm		
		19.0mm		
		13.2mm		
		9.5mm		
		6.7mm		
		4.75mm		
		2.36mm		
		1.18mm		
		0.600mm		
		0.300mm		
		0.150mm		
		0.075mm		
1141.12 ☐	T203 ☐	MATERIAL FINER THAN 75um	%	max
1141.14 ☐	T213 ☐	PARTICLE SHAPE 3:1 Ratio	%	max
1141.20 ☐	T235 ☐	AVERAGE LEAST DIMENSION	mm	min
1141.33 ☐	T268 ☐	CLAY & FINE SILT	%	max
		GENERAL REQUIREMENTS		
1141.5/6 ☑	T209 ☐	PARTICLE DENSITY (SSD)	1600 kg/m3	min
	T210 ☐	PARTICLE DENSITY (DRY)	1460 kg/m3	min
		WATER ABSORPTION	9.1 %	max
1141.4 ☐	T211 ☐	BULK DENSITY (Loose)	kg/m3	min
	T212 ☐	BULK DENSITY (Compacted)	kg/m3	min
		DURABILITY		
1141.22 ☐	T215 ☐	WET DRY STRENGTH VARIATION	%	max
		WET STRENGTH	KN	min
		DRY STRENGTH	KN	min
		SIZE OF TEST PORTION		
1141.23 ☐	T204 ☐	LOS ANGELES VALUE	%	max
		TEST GRADING		
1141.24 ☐	T266 ☐	SODIUM SULPHATE SOUNDNESS		
		LOSS ON EACH FRACTION		
		OVERALL WEIGHTED LOSS	%	max

REMARKS: TP2 0-2.5m.Coarse & fine material tested separately then averaged out.Submitted by PPK Singleton

This laboratory is registered by the National Association of Testing Authorities, Australia. The tests reported herein have been performed in accordance with its terms of registration.

Authorised Signatory: T.N. Cahill

Date: 24-6-98

PPK Environment & Infrastructure

PPK Environment & Infrastructure Pty Ltd
59 Sydney Road.Bathurst.NSW.2795
Materials Laboratory No. 1281
Phone: (02) 63314188 Fax: (02)63316798

EXRAGCON.XLS

Aggregates For Engineering Purposes

Client:	Stratford Coal	Job No.	63K057A
Project:	Co-Disposal	Sample No.	4520
Location:	Stratford	Depth:	
Source:	TP3 0-2.5m	Report No.	3

Sieve Size (mm)	% Passing	Specification
200		
75	100	
63	98	
53	95	
37.5	89	
26.5	81	
19	77	
13.2	71	
9.5	65	
6.7	54	
4.75	43	
2.36	29	
1.18	17	
0.600	11	
0.425	9	
0.300	7	
0.150	2	
0.075	0.1	

ATTERBERG LIMITS			Procedures
Liquid Limit	%		
Plastic Limit	%		
Plasticity Index	%		
Linear Shrinkage	%		
Mould Length	mm		
Crumbling / Curling			
Sample History			H,K
Sample Preparation			F

(A) AS 1289.3.1 . 1 Liquid Limit - Standard Method
(B) AS 1289.3.1 . 2 Liquid Limit - Subsidiary Method
(C) AS 1289.3.2 . 1 Plastic Limit - Standard Method
(D) AS 1289.3.3 . 1 Plasticity Index - Standard Method
(E) AS 1289.3.4 . 1 Linear Shrinkage - Standard Method
(F) AS 1289.3.6 . 1 Washed
(G) AS 1289.3.6 . 2 Dry Sieved
(H) OVEN DRIED
(I) DRY SIEVED
(J) RTA T201
(K) Sampled By PPK Personnel
(L) Sampled By Client

SOILS DESCRIPTION / USC: Coal Rejects

Remarks:

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Authorised Signatory: Date: 30.6.98

PPK Environment & Infrastructure Pty Ltd
100 George Street
Singleton NSW 2330
Laboratory No.1731

Client:	STRATFORD COAL	**Job No:**	63K057A
Project:	MATERIAL EVALUATION	**Report No:**	B3
Location:	STRATFORD	**Sample No:**	4520

AGGREGATES FOR ENGINEERING PURPOSES-CONCRETE

TEST AS1141	METHOD RTA	DESCRIPTION	TEST RESULT		SPECIFICATION	
		DIMENSIONAL REQUIREMENTS				
1141.11 ☐	T201 ☐	GRADING				
		75.0mm				
		53.0mm				
		37.5mm				
		26.5mm				
		19.0mm				
		13.2mm				
		9.5mm				
		6.7mm				
		4.75mm				
		2.36mm				
		1.18mm				
		0.600mm				
		0.300mm				
		0.150mm				
		0.075mm				
1141.12 ☐	T203 ☐	MATERIAL FINER THAN 75um		%		max
1141.14 ☐	T213 ☐	PARTICLE SHAPE 3:1 Ratio		%		max
1141.20 ☐	T235 ☐	AVERAGE LEAST DIMENSION		mm		min
1141.33 ☐	T268 ☐	CLAY & FINE SILT		%		max
		GENERAL REQUIREMENTS				
141.5/6 ☑	T209 ☐	PARTICLE DENSITY (SSD)	1780	kg/m3		min
	T210 ☐	PARTICLE DENSITY (DRY)	1630	kg/m3		min
		WATER ABSORPTION	8.8	%		max
141.4 ☐	T211 ☐	BULK DENSITY (Loose)		kg/m3		min
	T212 ☐	BULK DENSITY (Compacted)		kg/m3		min
		DURABILITY				
141.22 ☐	T215 ☐	WET DRY STRENGTH VARIATION		%		max
		WET STRENGTH		KN		min
		DRY STRENGTH		KN		min
		SIZE OF TEST PORTION				
1.23 ☐	T204 ☐	LOS ANGELES VALUE		%		max
		TEST GRADING				
141.24 ☐	T266 ☐	SODIUM SULPHATE SOUNDNESS				
		LOSS ON EACH FRACTION				
		OVERALL WEIGHTED LOSS		%		max

REMARKS: TP3 0-2.5m.Coarse & fine material tested separately then averaged out.Submitted by PPK Singleton

This laboratory is registered by the National Association of Testing Authorities, Australia. The tests reported herein have been performed in accordance with its terms of registration.

Authorised Signatory: T.N. Cahill

Date: 24-6-98.

PPK Environment & Infrastructure

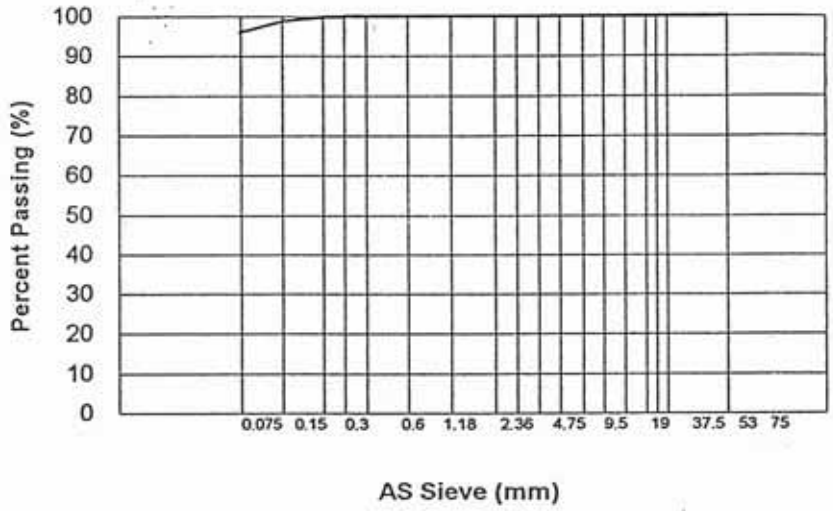
PPK Environment & Infrastructure Pty Ltd
59 Sydney Road.Bathurst.NSW.2795
Materials Laboratory No. 1281
Phone: (02) 63314188 Fax: (02)63316798

Aggregates For Engineering Purposes

Client:	Stratford Coal	Job No.	63K057A
Project:	Co-Disposal	Sample No.	4521
Location:	Statford	Depth:	
Source:	TP4 0-2.5m	Report No.	4

Sieve Size (mm)	% Passing	Specification
200	100.0	
75	100.0	
63	100.0	
53	100.0	
37.5	100.0	
26.5	100.0	
19	100.0	
13.2	100.0	
9.5	100.0	
6.7	100.0	
4.75	100.0	
2.36	100.0	
1.18	100.0	
0.600	100.0	
0.425	100.0	
0.300	99.5	
0.150	99.0	
0.075	96.0	

Particle Size Distribution



Test	Result	Specification
Average Least Dimension (m		
Fractured Faces (%)		
Material Finer than 75Fm (%)		

Material Description: Coal Rejects

Procedures Used: D,G,H,I

(A) RTA T201 (D) Oven Dried (G) Sampled By PPK Personnel

(B) RTA T235 (E) Dry Sieved (H) Sampled from Stockpile in accordance with AS1141.

(C) RTA T203 (F) Sampled By Client (I) AS 1289 Sieve to 75um

Comments

This laboratory is registered by the National Association of Testing Authorities, Australia. The tests reported herein have been performed in accordance with its terms of registration.

Authorised Signatory: M. Dwight Date: 30·6·98

PPK Environment & Infrastructure Pty Ltd
100 George Street
Singleton NSW 2330
Laboratory No.1731

PPK Environment & Infrastructure

Soil Particle Density - Report

Report No. 6119

Client:	PPK Pty Ltd
Project:	Client Project No 63K057A
Location:	Stratford
TEST METHOD :	AS1289.3.5.1

Job No.:	178929/04
Sample No.:	as shown
Test Hole No.:	TP 4
Depth (m) :	as shown
Client Sample ID :	as shown

SAMPLING HISTORY : Supplied by client

Client Sample ID	Testhole Depth (m)	LM Sample Number	Average Apparent Particle Density -2.36 mm (Pf) (g/cm3)	Average Apparent Particle Density +2.36 mm (Pf) (g/cm3)	Soil Particle Density (Pst) (g/cm3)	Temp. (oC)
4521	0.0 - 2.5	1670/01	2.06	n/a	2.06	18
SAMPLE DESCRIPTION :	dark grey silt					
SAMPLE DESCRIPTION :						
SAMPLE DESCRIPTION :						
SAMPLE DESCRIPTION :						
SAMPLE DESCRIPTION :						
SAMPLE DESCRIPTION :						
SAMPLE DESCRIPTION :						
SAMPLE DESCRIPTION :						

NOTES :

ABBREVATIONS :

n/a	not applicable
nt	not tested
n/av	not available

Tested by:	GV
Date tested:	1/07/98
Checked by:	
Certified by:	
Date:	21.7.98

GEOTECHNICAL TESTING SERVICES
36 Oxley Street, Crows Nest NSW 2065
Tel: (02) 9439 4033 Fax: (02) 9436 0606
LONGMAC ASSOCIATES PTY. LIMITED

This laboratory is accredited by the National Association of Testing Authorities, Australia. The tests reported herein have been performed in accordance with its terms of accreditation. Accreditation No. : 679

REF: 980502

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23 July 1998

Mr Owen Droop
Gilbert & Sutherland Pty Ltd
Soil and Water Resource Consultants
PO Box 2057
BARDON QLD 4065

Dear Owen

RE: LABORATORY TESTING OF STRATFORD WASHERY WASTES

1 INTRODUCTION

This report presents the results of laboratory testing carried out from 29 June to 16 July 1998 on a tailings and a co-disposal sample supplied from Stratford Mine. The testing comprised the determination of the drying soil water characteristic curves (SWCC) and saturated permeabilities of the two materials.

2 RESULTS OF LABORATORY TESTING

2.1 SWCC Testing

The drying SWCCs for the two materials were determined using Tempe cells for matrix suctions of up to 100 kPa and a pressure plate apparatus for matrix suctions of up to 500 kPa. The co-disposal material was obtained by combining the three supplied samples, scalped to pass 2.36 mm prior to testing. The data points are presented in Table 1 and plotted on Figures 1 and 2 for the tailings and coarse reject, respectively. The fitted SWCCs shown on Figures 1 and 2 were determined using the *SoilCover* software, based on the Fredlund and Xing method.

Table 1 Data points for SWCC for Stratford washery wastes

MATRIX SUCTION (kPa)	VOLUMETRIC WATER CONTENT	
	TAILINGS	CO-DISPOSAL
0.039	-	0.484
0.17	-	0.478
0.43	-	0.443
0.53	-	0.429
0.63	-	0.417
0.83	-	0.398
1.1	-	0.377
1.6	-	0.349
1.95	-	0.329
2.57	-	0.303
2.	-	0.291
3.5	-	0.264
4	-	0.251
5	0.599	0.230
6	-	0.213
7	-	0.204
8	-	0.195
9	-	0.186
10	0.533	0.175
15	-	0.159
20	0.438	0.146
30	0.426	0.130
36	-	0.123
40	0.402	-
50	0.395	-
100	0.353	-
200	0.308	-
300	0.280	-
400	0.261	-
500	0.240	0.080

The fitting parameters for the tailings and co-disposal were A = 3.41, N = 1.28, M = 0.55, and A = 1.06, N = 1.31, M = 0.87, respectively.

2.2 Saturated Permeability Testing

The tailings sample was subjected to saturated permeability testing in a 75 mm diameter Rowe cell, under vertical loading and two-way vertical drainage. The resulting saturated permeability values are tabulated against applied vertical stress in Table 2 and plotted against applied vertical stress on Figure 3.

Table 2 Saturated permeability versus applied vertical stress for Stratford tailings

APPLIED VERTICAL STRESS (kPa)	SATURATED PERMEABILITY (m/s)
2	3.27E-7
10	2.50E-8
50	3.15E-9
100	1.69E-9
200	1.24E-9

The combined co-disposal sample, scalped to pass 9.5 mm, was subjected to saturated permeability testing in a constant head apparatus, under negligible vertical loading and upward vertical flow. The resulting saturated permeability value was 6.00E-6 m/s.

Should you have any queries regarding the results contained in his report, please do not hesitate to contact the author. We thank you for the opportunity to be of assistance to you, and would be pleased to offer any further assistance required.

Yours sincerely

David J

Dr David J Williams
BE (Hons I), PhD, MIEAust, CPEng

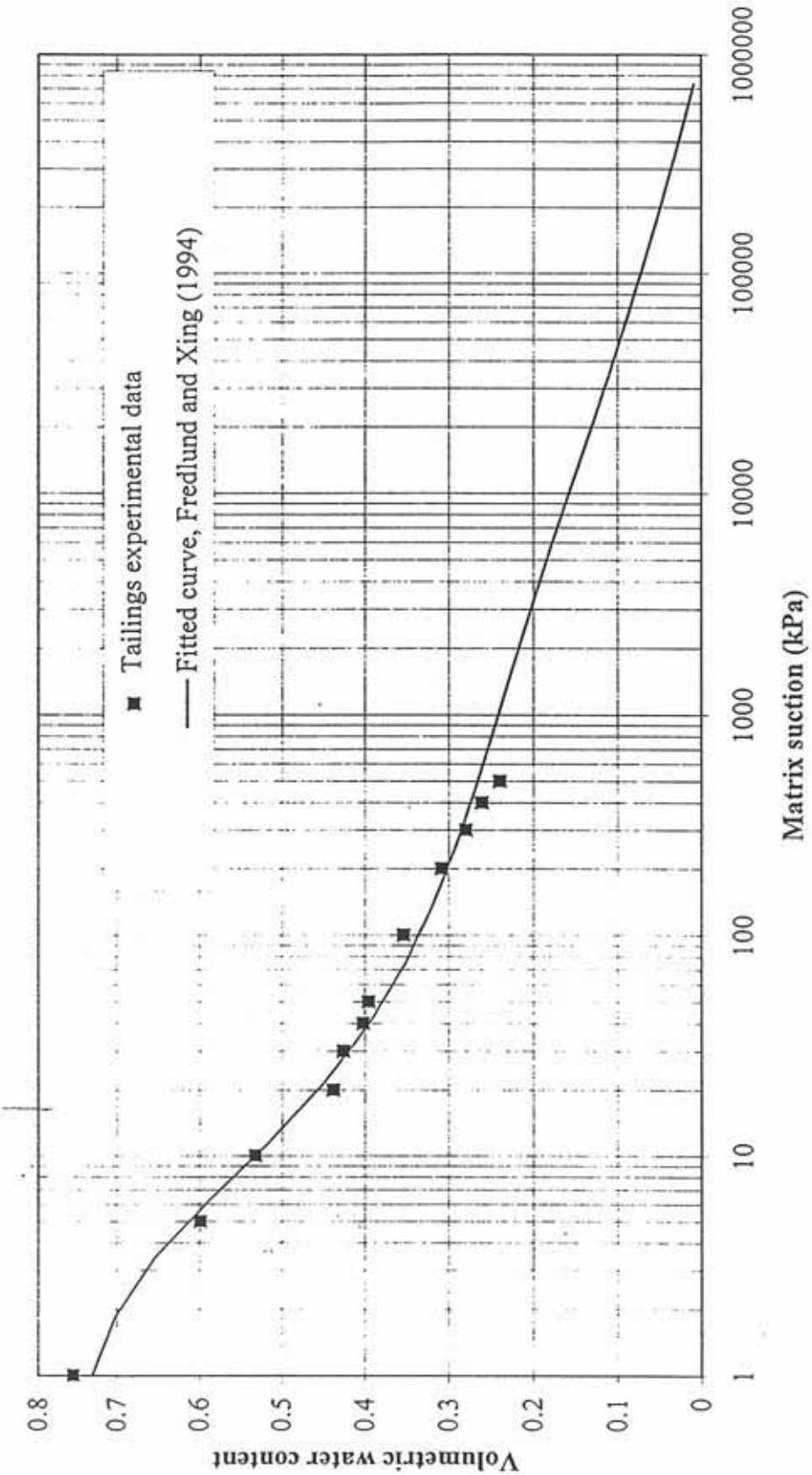

Figure 1 SWCC for Stratford tailings

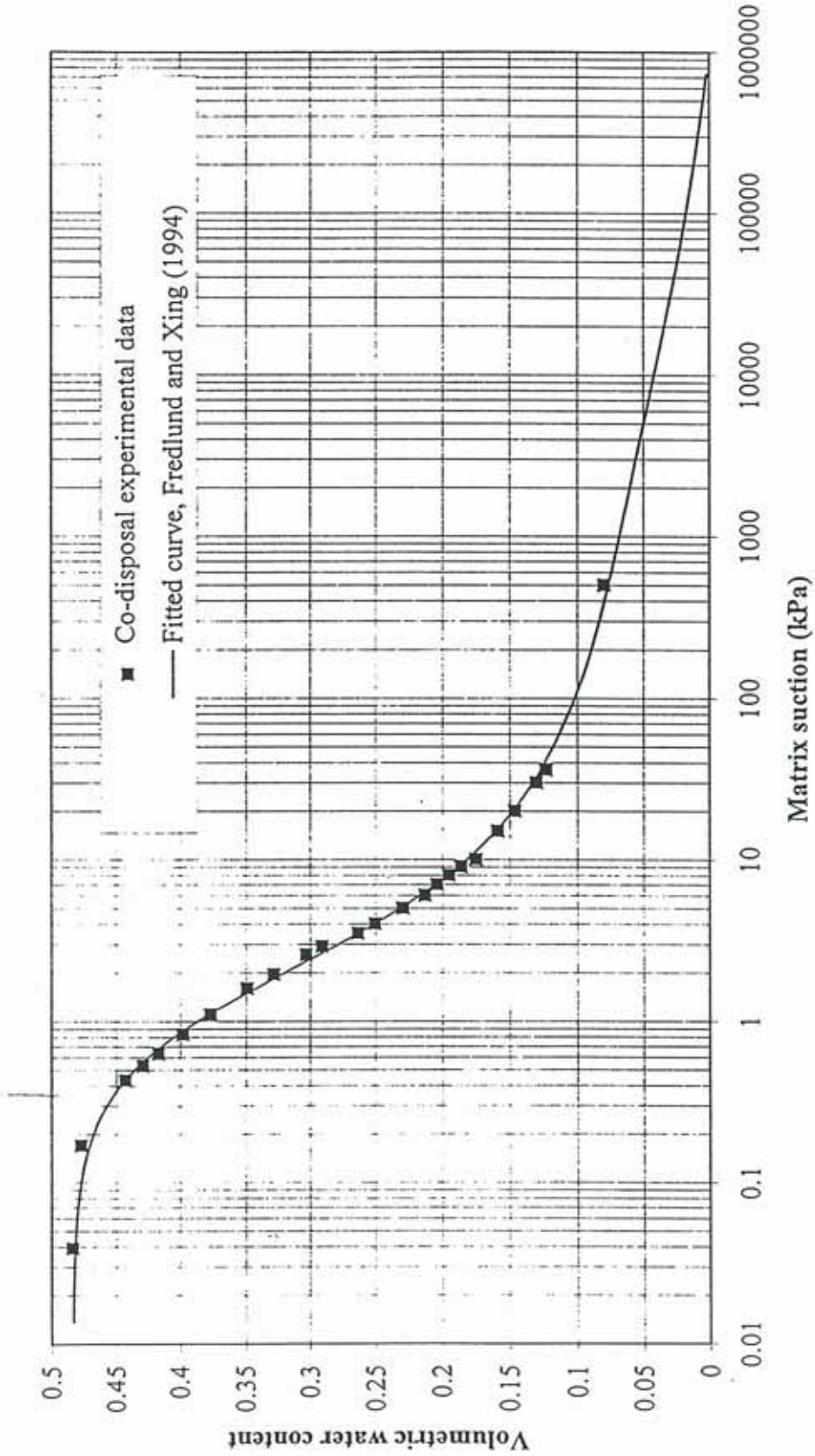

Figure 2 SWCC for Stratford co-disposal

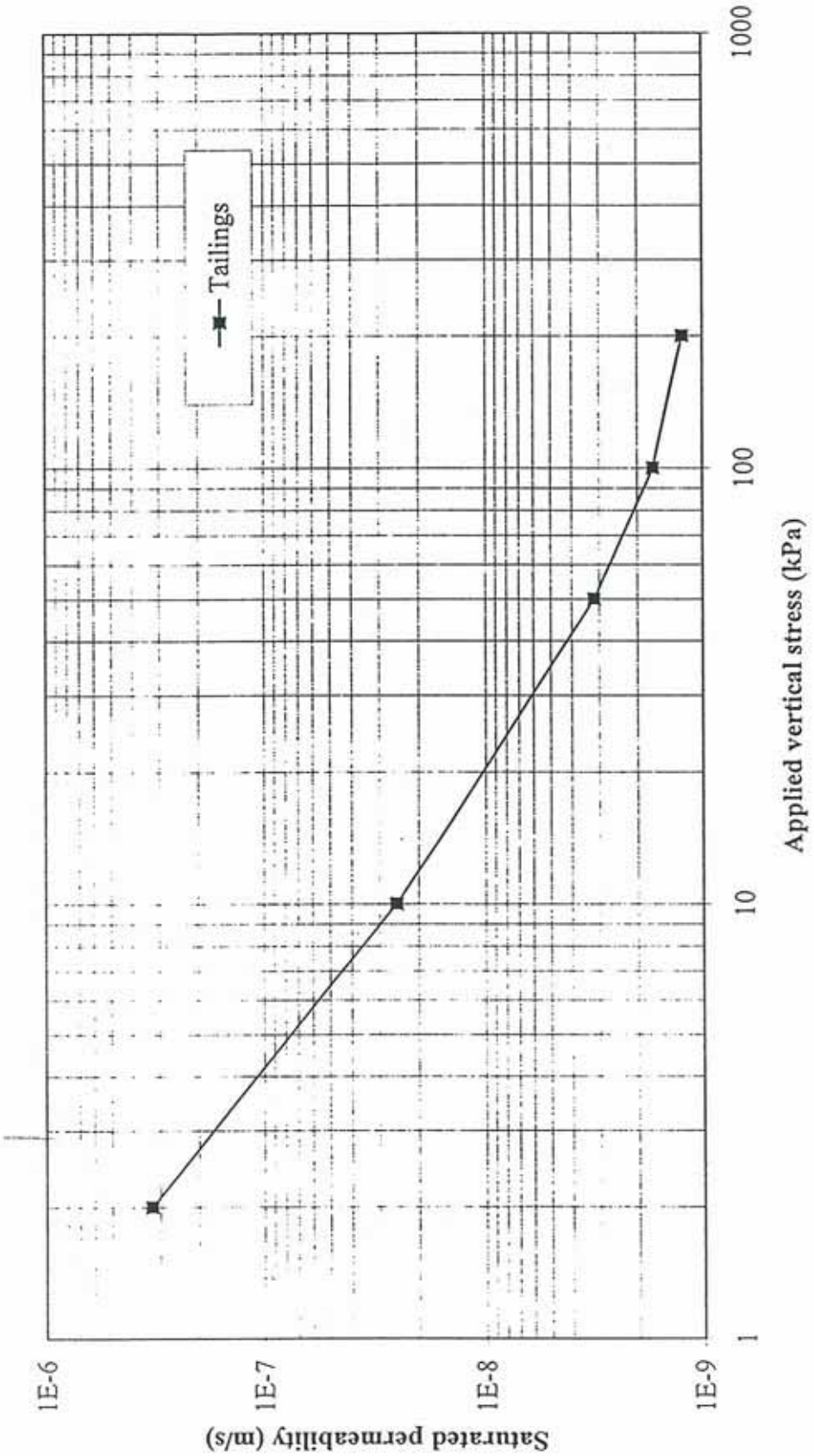

Figure 3 Saturated permeability versus applied vertical stress for Stratford co-disposal

APPENDIX B

REPORT FROM RICHARD HEGGIE ASSOCIATES PTY LTD
STRATFORD COAL MINE TRAIN UNLOADING OPERATIONS
PRELIMINARY NOISE IMPACT ASSESSMENT

Quality System

Quality Endorsed Company

ISO 9001 Lic 3236
Standards Australia

REPORT 8140-R1
Revision 1

STRATFORD COAL MINE TRAIN UNLOADING OPERATIONS PRELIMINARY NOISE IMPACT ASSESSMENT

Prepared for

Resource Strategies Pty Ltd
Level 1, 11 Lang Parade
MILTON QLD 4064

On behalf of

CIM Resources
Level 32 Westpac Plaza
60 Margaret Street
SYDNEY NSW 2001

27 August 1998

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REPORT 8140-R1
Revision 1

STRATFORD COAL MINE TRAIN UNLOADING OPERATIONS PRELIMINARY NOISE IMPACT ASSESSMENT

Quality System

Richard Heggie Associates Pty Ltd operates under a Quality System which has been certified by Quality Assurance Services Pty Limited to comply with all the requirements of ISO 9001:1994 "Quality Systems - Model for Quality Assurance in Design, Development, Production, Installation and Servicing" (Licence No 3236).

This document has been prepared in accordance with the requirements of that System.

Association of Australian Acoustical Consultants - AAAC

Richard Heggie Associates is a Member Firm of the Association of Australian Acoustical Consultants.

Reference	Status	Date	Prepared	Checked	Authorised
N180\8140R1	Revision 0	3.6.98	GT	GT	RH
S73\8140R1R1	Revision 1	27.8.98			

STRATFORD COAL MINE TRAIN UNLOADING OPERATIONS PRELIMINARY NOISE IMPACT ASSESSMENT

TABLE OF CONTENTS

STRATFORD COAL MINE TRAIN UNLOADING OPERATIONS PRELIMINARY NOISE IMPACT ASSESSMENT

RESOURCE STRATEGIES

1 INTRODUCTION

In December 1994, Stratford Coal Pty Ltd was granted approval to develop the Stratford Coal Mine (SCM) as an open-cut mine utilising truck and shovel extraction methods with on-site coal processing, producing 1.1 Mtpa of saleable coal. In July 1996, approval was given to increase the production of saleable coal to 1.7 Mtpa.

The mine is situated between the townships of Stratford and Craven NSW, with consent to operate for a period of 14 years.

Richard Heggie Associates (RHA) has been engaged by Resources Strategies Pty Ltd to conduct a preliminary noise impact assessment of proposed operating variations at Stratford Coal Mine involving the rail transportation of ROM coal from the Duralie Coal Mine for processing at Stratford.

The objectives of this preliminary noise impact assessment are therefore as follows:

- To identify the key noise assessment locations in Stratford and Craven villages.
- To distil the existing mine noise emission database and identify noise emissions from current train loading operations, then qualify the potential noise impact of the proposed train unloading operation.
- To distil the existing mine noise emission database and identify noise emissions from current mine operations, then qualify the potential noise impact associated with the 35% reduction in ROM coal extraction at Stratford.
- To identify and assess existing freight and passenger train movements along the Northern Railway, together with mine generated train movements.
- To summarise the potential noise impact associated with the proposed operating variations in relation to the current overall environmental noise emission levels.

2 APPROVAL REQUIREMENTS

2.1 Development Consent Conditions

Attached as **Appendix A** is a copy of the Department of Urban Affairs and Planning's (DUAP) Development Consent dated 19 December 1994 and subsequent Notice of Modification dated 17 July 1996.

Mine Operating Noise Criteria

The Consent nominates mine operating noise criteria in Section - Noise, Item 4 as follows:

"The applicant shall:

i. measure and record the $L_{A10(15minute)}$ noise level over a minimum 72 hour period at the Perrin, Isaacs, Atkins, Fragley properties and other locations specified by EPA, during normal operation of the mine, on a quarterly basis such that the 40 dBA daytime and 35 dBA night-time noise levels are able to be presented in respect of the mine site and surrounding area, or as otherwise required by EPA.

ii. submit a management plan for information of Gloucester Council ("Council") and approval by EPA, giving noise safeguards and procedures for dealing with noise episodes which exceed the above L_{A10} noise levels, as required by EPA.

iii. institute appropriate noise attenuation measures, to the satisfaction of the EPA, to ensure the residents of the Fragley residence are not subject to offensive noise emitted from the mine.

iv. prepare, in consultation with the EPA, and to the satisfaction of the EPA, a noise reduction program detailing an on-going program of investigation and implementation of noise reduction measures."

Hours of Operation

The Notice nominates hours of operation in Section - Hours of Operation for Roseville Pit, Item 4A as follows:

> "All activities associated with construction and operation of the Roseville pit shall be confined to the hours between 7.00 am and 10.00 pm."

Existing mining operations are conducted over three 8 hour continuous shifts Monday to Saturday throughout the year, with changeovers at 0700 hours, 1500 hours and 2300 hours.

2.2 Environment Protection Authority's (EPA's)

Attached as **Appendix B** is a copy of the EPA's Pollution Control approval Number 001495 dated 6 January 1995 (**Appendix B1**) and EPA Licence Number 005161 current to 30 June 1998 (**Appendix B2**). The EPA recently issued a Notice under Section 17(D)3 of the Pollution Control Act 1970 dated 18 September 1997 which documents the requirements of a Noise Reduction Programme (**Appendix B3**).

Mine Operating Noise Criteria

The EPA's Licence (005161) nominates Mine Operating Noise Criteria in Section P1 Noise Reduction Programme, Item 1 Environmental Outcomes as follows:

"(a) the sound pressure level $L_{A10,T}$ (T = 15 minutes) of noise emanating from the Premises does not exceed L_{A10} 40 dBA during Daytime and does not exceed L_{A10} 35 dBA during Night-time when measured at any point within 20 metres of a residential dwelling located outside of the Premises;

(b) all noise emissions from the Premises are substantially free of tonal characteristics during Daytime and Night-time; and

(c) all noise emissions from the Premises are substantially free of impulsive characteristics during Daytime and Night-time.

Definitions:

In this Condition:

"Daytime" means:

(a) From Monday to Saturday - 7.00 am to 10.00 pm;
(b) On Sundays and public holidays - 8.00 am to 10.00 pm.

"Night-time" means:

(a) From Monday to Saturday - 10.00 pm to 7.00 am;
(b) On Sundays and Public Holidays - 10.00 pm to 8.00 am."

2.3 Interpretation of the Noise Criteria

The Consent and Licence do not make reference to meteorological conditions under which the noise emission limits apply. In addition, the EPA's Environmental Noise Control Manual (1993) does not define a methodology or procedure for assessing the effects of meteorological conditions on noise propagation (ie air absorption, wind speed/direction, temperature inversion and turbulence).

The EPA has however, provided guidance in a separate document "Use of Meteorological Conditions when Assessing Operational Noise" undated for projects of this nature which is attached as **Appendix C**. The document states:

> *"With regard to setting statutory conditions such as in development consents, the term "prevailing" would be recommended in conjunction with any performance based noise limit that is applied to the project. Prevailing weather conditions include calm and windy conditions but excludes temperature inversions."*

It is therefore concluded that the Consent (DUAP) and Licence (EPA) noise emission limits would apply under prevailing weather conditions including adverse winds which may enhance noise emission levels, but exclude any noise enhancement due to temperature inversions.

4 MONITORING LOCATIONS AND NOISE MONITORING DATABASE

The project site and surrounding area are illustrated in the Location Plan attached as **Appendix D**. **Table 4.1** describes the existing noise emission database, including seventeen assessment locations (BG1-BG4, BG4A, BG5, BG5A, BG6-BG12, BG12A, BG13 and BG14) selected to be representative of the noise environment in the potentially affected areas, which form the basis for evaluating and assessing noise emissions from the project.

Table 4.1 Monitoring Locations and Measurement Procedures

Location No	Proprietor/Tenant	Description	Number of Measurements	
			15 Minute Attended	Continuous Logging
BG1	Atkins	Wheatleys Road, Stratford	7	1
BG2	Van Der Drift	Wood Street, Stratford	15	7
BG3	Isaac[2]	Bucketts Way, Stratford	33	9
BG4	Bagnall	Bucketts Way, Craven	31	6
BG4A	Bramley	Bucketts Way, Craven	0	0
BG5	Craven[1]	Bucketts Way, Craven	6	3
BG5A	Standen	Woods Street, Craven	26	4
BG6	Blanch[1]	Bucketts Way, Craven	0	0
BG7	Perrin[1]	Bucketts Way, Craven	4	1
BG8	Wadland	Bowens Road, Stratford	9	6
BG9	Bailey	Glen Road, Craven	7	1
BG10	Hickman	"Glengariff", Stratford	2	1
BG11	Bignell	"Marengo", Stratford	1	0
BG12	Butler[1]	18 Avon Road, Stratford	4	0
BG12A	Judge[1]	27 Avon Road, Stratford	19	6
BG13	Cossill	Deards Lane, Stratford	1	1
BG14	Ross	High Street, Stratford	15	3

Note 1 Stratford Coal owned property
Note 2 BG3 Isaac "reference site"

It should be noted that noise measurements carried out at BG4 Bagnall are also representative of the noise environment at BG4A Bramley. Similarly, noise measurements conducted at BG5A Craven are also representative of the noise environment at BG5A Standen.

For the purposes of evaluating the train unloading noise impact the key assessment locations are represented in **Table 4.2** together with the minimum distance to existing rail loading facility and proposed rail unloading facility.

Table 4.2 Key Noise Assessment Locations

Property	Description	Approximate Distance		
		Rail Loading	Rail Unloading	Main Pit
BG2 Van Der Drift	Representative dwelling for Stratford Village	1920 m	2130 m	2220 m
BG3 Isaac	Nearest potentially affected dwelling to overall mine operating noise emissions	1090 m	1250 m	2060 m
BG4 Bagnall (BG4A Bramley)	Nearest potentially affected dwellings to train loading and unloading noise emissions	1230 m (1170 m)	1130 m (1040 m)	2540 m (2430 m)
BG5 Craven (BG5A Standen)	Representative dwellings for Craven Village	2160 m (2200 m)	1920 m (1960 m)	2370 m (2750 m)

5 RAIL UNLOADING IMPACT ASSESSMENT

5.1 Description of Rail Loading and Unloading Infrastructure

The existing rail unloading facilities are shown on the Product Conveyor diagram attached as **Appendix E**. The two alternative rail unloading options comprise a Radial or Conical coal stockpile as shown on the Processing Site Plans attached as **Appendix F**.

The existing 3,000 t/hr rail loading facility together with the measured sound power levels (SWLs) are presented in **Table 5.1.1**. Note, the rail loading facility comprises the CAT D10 Dozer, Product Conveyor 2 and Drive, Rail Loadout Bin and locomotives.

Table 5.1.1 Existing 3000 t/hr Rail Loading Facility and Balloon Loop

Item	Description	Overall SWL
Product Conveyor 1 and Drive	Partially enclosed 200 m conveyor length	109 dBA
Product Stockpile Coal Discharge	100,000 t capacity, 20 m height conveyor to stockpile	100 dBA
CAT D10 Dozer	Dozer tracking on coal stockpile	120 dBA
Product Conveyor 2 and Drive	Partially enclosed 100 m conveyor length	108 dBA
Rail Loadout Bin	425 t rail loadout bin dumping into coal wagons	110 dBA
Locomotives	2 off 90 Class locomotives	112 dBA
TOTAL SWL	**Rail Loading Facility**	**121 dBA**

The existing product stockpile pad will be extended by 40 m to accommodate Duralie product coal. This will also include a 36 m extension to the Product Conveyor 1.

The proposed 1500 t/hr rail unloading facility would be established on the existing balloon loop. The measured and estimated sound power levels (SWLs) are presented in **Table 5.1.2**.

Table 5.1.2 Proposed 1500 t/hr Rail Unloading Facility

Item	Description	Overall SWL
Product Conveyor 1	36 m Product Conveyor 1 extension	100 dBA
Locomotives	2 off 90 Class Locomotives	112 dBA
Rail Unloading Bin	Enclosed 1600 t, bottom dump hopper	102 dBA
ROM Conveyor 1	200 m ROM coal conveyor	109 dBA
Conical Stockpile	15000 t capacity, 22 m high	100 dBA
Radial Stockpile	12000 t capacity, 9 m high	100 dBA
CAT D10 Dozer	Dozer tracking, feeding dump hopper	120 dBA
ROM Conveyor 2	180 m ROM coal conveyor	109 dBA
TOTAL SWL	**Rail Unloading Facility**	**121 dBA**

5.2 Train Unloading Noise Impact Assessment

The following information is derived from the description of train loading and unloading facilities presented in **Section 5.1**:

Existing Train Loading Facility

- The total overall sound power level of the existing rail loading facility is 121 dBA.
- Train loading and train unloading operations can not occur simultaneously, therefore it is not necessary to consider cumulative noise impacts. However, train operations (ie rail loading or rail unloading) will occur at twice the current frequency with up to eight train movements per day.
- The two most significant noise sources from existing train loading operations are from the operation of the dozer on the 100,000 t coal stockpile and the dumping of coal into coal wagons.

Train Unloading Facility – Conical Stockpile

- The total overall sound power level of the proposed rail unloading facility (conical stockpile) is 121 dBA.
- It is reasonable to assume that noise emissions from the proposed train unloading facility would be equivalent to the existing train loading facility as the dozer would operate (as required) on the conical stockpile (maximum 22 m) which is similar to the product stockpile (maximum 20 m).

- The proposed 7 m high visual and acoustic barrier would be significantly less effective for the conical stockpile option, as the dozer would operate (as required) up to a maximum stockpile height of 22 m. However, the barrier would provide appreciable noise attenuation to the ROM coal conveyors and reclaim hopper.
- In view of the proposed doubling of train movements, the magnitude of train-related (ie rail loading or rail unloading) noise emissions would remain unchanged but occur at approximately twice the frequency.

Train Unloading Facility – Radial Stockpile

- The total overall sound power level of the proposed rail unloading facility (radial stockpile) is 121 dBA.
- It is reasonable to assume that noise emissions from the proposed train unloading facility would be equivalent or only marginally (1 dBA) less than the existing train loading facility as the dozer would operate (as required) on the radial stockpile (maximum 9 m) which is well below the elevation of the product stockpile (maximum 20 m).
- The proposed 7 m high visual and acoustic barrier would be more effective for the radial stockpile option, as the dozer would operate (as required) up to a maximum stockpile height of 9 m. The barrier would also provide appreciable noise attenuation to the ROM coal conveyors and reclaim hopper.
- In view of the proposed doubling of train movements, the magnitude of train-related (ie rail loading or rail unloading) noise emissions would remain unchanged but occur at approximately twice the frequency.

5.2.1 Existing Train Loading Noise Emissions

The results of the noise monitoring programme have been distilled to identify noise emission levels from current train loading operations at the four key assessment locations. The measured overall mine and estimated train loading (ie train loading, wagon and locomotive noise) $L_{A10(15minute)}$ noise emissions are presented in **Table 5.2.1.1**, together with the maximum (L_{Amax}) noise emissions arising from dozing operations on the product stockpile.

Table 5.2.1.1 Operator-Attended Noise Emission Levels

Key Location	Date Time (hours) Wind	Train Arrival Departure Date and Time (hours)	Overall Mine $L_{A10(15minute)}$	Estimated Train $L_{A10(15minute)}$	Train Comment	Dozer Comment L_{Amax}
BG4 Bagnall	27.9.96 0045 Calm	27.9.96 0015 27.9.96 0130	47 dBA	45 dBA	Constant loading and locomotive	Stockpile 52 dBA
BG4 Bagnall	6.2.97 0400 E	6.2.97 0355 6.2.97 0443	42 dBA	40 dBA	Train loading clearly audible	Tracks 42 dBA
BG4 Bagnall	9.5.97 0335 SW	9.5.97 0310 9.5.97 0400	45 dBA	44 dBA (Lmax 50 dBA)	Train loading clearly audible	Tracks 48 dBA
BG4 Bagnall	12.8.97 2200 SSE	12.8.97 2145 12.8.97 2350	33 dBA	<30 dBA	Train loading inaudible	Dozer Inaudible
BG4 Bagnall	13.8.97 0045 SSE	12.8.97 2230 13.8.97 0115	39 dBA	<30 dBA	Train loading inaudible	Tracks 42 dBA
BG4 Bagnall	14.8.97 2200 WNW	14.8.97 2140 15.8.97 0040	46 dBA	<30 dBA	Train loading inaudible	Tracks just audible
BG4 Bagnall	15.8.97 0030 NW	14.8.97 2140 15.8.97 0040	45 dBA	42 dBA	Train loading clearly audible	Dozer Inaudible
BG4 Bagnall	13.11.97 2345 WNW	14.11.97 2300 15.11.97 0020	42 dBA	40 dBA	Train loading clearly audible	Dozer inaudible
BG4 Bagnall	13.2.98 0110 ENE	12.2.98 2320 13.2.98 0047	38 dBA	34 dBA	Locomotive audible	Tracks audible
BG4 Bagnall	12.2.98 2330	12.2.98 2320 13.2.98 0047	44 dBA	<30 dBA	Train loading inaudible	Tracks 54 dBA
BG5A Standen	6.2.97 0020 SSW	5.2.97 2355 6.2.97 0047	42 dBA	<30 dBA	Train loading inaudible	Tracks 42 dBA
BG5A Standen	9.5.97 0310 SSW	9.5.97 0310 9.5.97 0400	40 dBA	<36 dBA (L_{Amax} 43 dBA)	Train dump audible	Tracks 43 dBA
BG5A Standen	13.8.97 0015 SSE	12.8.97 2230 13.8.97 0115	31 dBA	<20 dBA	Train loading inaudible	Tracks just audible
BG5A Standen	14.8.97 0000 WNW	14.8.9 2140 15.8.97 0040	40 dBA	<30 dBA	Train loading inaudible	Dozers inaudible
BG5A Standen	13.11.97 2315 SW	14.11.97 2300 15.11.97 0020	39 dBA	<30 dBA	Train loading inaudible	Tracks audible
BG3 Isaac	15.8.96 0045 SW	27.9.96 0015 27.9.96 0130	45 dBA	<30 dBA	Train loading inaudible	Stockpile 51 dBA
BG3 Isaac	12.8.97 2230 S	12.8.97 2145 12.8.97 2350	44 dBA	<30 dBA	Train loading inaudible	Tracks audible
BG3 Isaac	15.8.97 2230 NW	14.8.97 2140 15.8.97 0040	49 dBA	<43 dBA (L_{Amax} 45 dBA)	Train dump audible	Dozers inaudible
BG3 Isaac	13.11.97 0015 ENE	14.11.97 2300 15.11.97 0020	46 dBA	<30 dBA	Train loading inaudible	Tracks 48 dBA
BG3 Isaac	13.2.98 0030 NNE	12.2.98 2320 13.2.98 0047	34 dBA	<30 dBA	Train loading inaudible	Tracks just audible
BG2 Van Der	13.2.98 0010 ENE	12.2.98 2320 13.2.98 0047	28 dBA	<20 dBA	Train loading inaudible	Dozers inaudible

Impact Assessment

- Existing train loading noise emissions (ie train loading, wagon and locomotive noise) at BG4 Bagnall (and BG4A Bramley) are clearly discernible from other mine generated noise emissions, where the maximum recorded $L_{A10(15minute)}$ noise level was 45 dBA.
- Dozer tracking noise emissions whilst operating on the product stockpile are also clearly audible at BG4/A Bagnall with a maximum recorded (L_{Amax}) level of 54 dBA.
- Train loading noise emissions at BG3 Isaac and BG5/A are occasionally audible with maximum (L_{Amax}) levels of 45 dBA and 43 dBA respectively but remain less discernible from other mine-generated noise emissions.
- Dozer tracking noise emissions, whilst operating on the product stockpile are clearly audible at BG3 Isaac (L_{Amax} 51 dBA) and also audible at BG5/A Craven (L_{Amax} 43 dBA).
- Train loading and dozer tracking (product stockpile) have not been recorded at BG2 Van Der Drift during the monitoring programme.

6 OVERALL MINE OPERATING NOISE IMPACT ASSESSMENT

6.1 Description of Mine Equipment Schedule

The current and proposed mine equipment schedules are presented in **Table 6.1.1**. It is anticipated that the existing mobile equipment fleet currently extracting up to 3.4 Mtpa of ROM coal would be scaled down in order to extract up to 2.1 Mtpa, with the production of saleable coal remaining at 1.7 Mtpa.

Table 6.1.1 Existing and Proposed Mine Equipment Schedule

Equipment Description	Existing 3.4 Mtpa/1.7 Mtpa		Proposed 2.1 Mtpa/1.7 Mtpa	
	No of Items	Sound Power Level (dB re 1 pW)	No of Items	Sound Power Level (dB re 1 pW)
Drills	1	116	1	116
Excavators (Coal)	2	115	2	115
Excavators (Waste)	3	122	2	120
789 Haul Trucks	6	132	6	132
785 Haul Trucks	7	131	6	131
777 Haul Trucks	3	123	-	-
Dozers (Inpit)	1	114	1	114
Dozers (Dump)	1	119	1	119
Dozers (Stockpile)	1	120	1	120
Loaders (ROM)	1	117	1	117
Graders	1	115	1	115
Water Truck	1	120	1	120
Coal Preparation Plant	1	122	1	122
Rail Loading	1	121	-	-
Rail Loading/Rail Unloading	-	-	1	121
TOTAL SWL	**30**	**136**	**25**	**136**

6.2 Overall Mine Noise Impact Assessment

The following information is derived from the description of mine equipment presented in **Section 6.1**:

- The total overall sound power level of the existing 3.4 Mtpa/1.7 Mtpa mining operation (including rail loading) is 136 dBA.
- The total overall sound power level of the proposed 2.1 Mtpa/1.7 Mtpa mining operation (including rail loading or rail unloading) is 136 dBA.
- It is concluded that overall magnitude mine noise emission levels will remain unchanged as a result of the proposed operating variations.

6.3 Existing Overall Mine Noise Emission Levels

A summary of the night-time operator-attended noise measurements conducted periodically since the increase from 1.2 Mtpa to 1.7 Mtpa of saleable coal to the four key assessment locations is presented in **Table 6.3.1**.

Table 6.3.1 Summary of Operator-Attended Night-time $L_{A10(15minute)}$ Emission (dBA re 20 µPa)

Date	BG2 Van Der Drift	BG3 Isaac	BG4 Bagnall (BG4A Bramley)	BG5A Standen (BG5 Craven)
26 Sep 1996	44	45	47	42[1]
8 Oct 1996	31	37	36	42
15 Oct 1996	34	44	44	43
5 Feb 1997	-	35	40 42	42
5 May 1997	40	43 42 50	38 41 43	<30 <35 <30
8 May 1997	-	48 52	43 45 45	38 39 40
12 Aug 1997	-	44 49 52	33 40 43	34 32 40
14 Aug 1997	-	49 45	46 45	41 40 42
21 Aug 1997	-	36	-	-
10 Nov 1997	-	36	36	40 36
11 Nov 1997		39	41	37
13 Nov 1997	-	44 46 33	44 42	39 39
9 Feb 1998	38 33 40	30 39 30	33 38 34	30 31 33
12 Feb 1998	39 28 28	43 34 31	44 38 37	40 38 37

Note 1: BG5 Craven

The operator-attended night-time $L_{A10(15minute)}$ emission levels can be further distilled in order to provide a subjective impact of the existing overall mine noise emission levels as presented in **Table 6.3.2**.

Table 6.3.2 Compliance Conditions and Noise Impact Assessment

Location	Mine Emissions	Effect of Atmospheric Conditions for Compliance	Subjective Impact[1]
BG2 Van der Drift	31 dBA - 44 dBA	Compliance under calm and favourable conditions, however occasional exceedances during moderate inversions or adverse wind	Moderate
BG2 Isaac	30 dBA - 52 dBA	Compliance under favourable conditions, however exceedances during almost all other conditions	High
BG4 Bagnall (BG4A Bramley)	33 dBA - 47 dBA	Compliance under favourable conditions, however exceedances during almost all other conditions, dwelling affected by rail loading operations	High
BG5A Standen (BG5 Craven)	<30 dBA - 43 dBA	Compliance under calm and favourable conditions, however frequent exceedances due to the prevailing north-northeasterly cold air drainage flow (ie temperature inversion and adverse wind)	Moderate

Note 1: Based on relative exceedance of EPA noise intrusion criteria $L_{A10(15minute)}$ 35 dBA night-time.

7 RAIL TRANSPORTATION NOISE IMPACT ASSESSMENT

7.1 Rail Transportation Noise Assessment Criteria

The EPA rail traffic noise control guideline provides noise criteria for residential receivers specified as both a 24 hour L_{Aeq} (equivalent continuous noise level) and as a maximum passby level, neither of which should be exceeded. The guideline gives maximum levels of:

$L_{Aeq\ 24hour}$ = 60 dBA and
L_{Amax} = 85 dBA

These guideline levels are normally evaluated at the most exposed property boundary.

The philosophy behind applying a 24 hour equivalent continuous noise level criterion is that being “averaged” throughout the day, it is sensitive to both the noise level of individual events and the number of noise events.

7.2 Existing and Proposed Rail Traffic

The existing and proposed mine generated train movements are presented in **Table 7.2.1**. The proposed inbound Duralie ROM coal would be transported on a dedicated twenty (20) wagon locomotive train.

Table 7.2.1 Mine Generated Train Movements (ie Arrival and Departure)

Train Requirement	Coal Rate/Type	Average Daily	Peak Daily
Existing (Outbound) Stratford Mine	1.7 Mtpa Product	1.5 (7 day week)	4
Proposed (Inbound) Duralie Mine	0.9 to 1.3 Mtpa ROM	1.5 to 2.2 (7 day week) 2.1 to 3.1 (5 day week)	4
Proposed (Outbound) Stratford Mine	1.7 Mtpa Product	1.5 (7 day week)	4
Total Proposed Stratford/Duralie	2.6 to 3.0 Mtpa	3.0 to 3.7 (7 day week) 3.6 to 4.6 (5 day week)	8

Note: It is assumed that inbound Duralie trains will unload ROM coal and depart empty.

The numbers of existing freight and passenger train movements (as provided by the State Rail Authority) and the anticipated additional freight movements of inbound ROM coal are presented in **Table 7.2.2**, together with the estimated operating conditions whilst travelling on the North Coast Line in the vicinity of Craven and Stratford Villages.

Table 7.2.2 Existing and Proposed North Coast Railway Line Rail Movements

Existing/ Proposed	Train Type	Period of Week	Average Passby Per Day	Peak Passby Per Day	Train Length (m)	Train Speed (kph)	Throttle Setting (Notch)
Existing	Freight	Mon - Sat	14	16	600	60	4
Existing	Freight	Sun	10	11	600	60	4
Existing	Passenger	Mon - Sat	6	6	190	80	4
Existing	Passenger	Sun	6	6	190	80	4
Existing	Stratford	Mon - Sun	3	8	750	60	4
Proposed	Duralie	Mon - Sun	4	8	375	60	4
Total Monday to Saturday			**27**	**38**			
Total Sundays			**23**	**33**			

7.3 Prediction of Rail Traffic Noise

Calculation of the 24 hour equivalent continuous noise level (L_{Aeq}) and the maximum (L_{Amax}) passby levels have been conducted using a computer prediction model developed by Richard Heggie Associates.

The prediction model uses characteristic noise levels for the various sources (locomotive engine and exhaust noise as a function of throttle notch, wheel/rail noise as a function of train speed, and wagon type, etc) at a fixed reference distance. The model then makes adjustments for the train length and the actual distance from the track. Parameters including the $L_{Aeq(24hour)}$ and maximum passby level (L_{Amax}) can then be determined by summing the effects of individual noise sources and by incorporating the number of daily train events.

The calculated $L_{Aeq(24hour)}$ and maximum L_{Amax} noise levels for the existing, Duralie mine-generated and total train movements in the vicinity of the project are presented in **Table 7.3.1**.

Table 7.3.1 Predicted Existing, Duralie and Total Train Noise Emissions

Distance to Receiver	Existing Trains - dBA			Proposed Duralie Trains - dBA			Total Trains - dBA		
	Average $L_{Aeq(24hour)}$	Peak $L_{Aeq(24hour)}$	L_{Amax}	Average $L_{Aeq(24hour)}$	Peak $L_{Aeq(24hour)}$	L_{Amax}	Average $L_{Aeq(24hour)}$	Peak $L_{Aeq(24hour)}$	L_{Amax}
25 m	59	60	89	49	52	84	59	60	89
50 m	56	57	86	47	49	80	56	58	86
100 m	53	55	82	44	47	76	54	55	82

The following impact assessment is derived from the results presented in **Table 7.3.1** and the EPA's recommended noise criteria of $L_{Aeq(24hour)}$ of 60 dBA and L_{Amax} of 85 dBA:

a. A comparison of the existing average traffic $L_{Aeq(24hour)}$ noise emissions with the total train noise emissions (ie including proposed Duralie movements), indicates that existing noise levels would increase only marginally (<1 dBA) and still meet below the EPA's 60 dBA criterion at a distance of 25 m.

b. A comparison of the existing peak traffic $L_{Aeq(24hour)}$ noise emissions to the total train noise emissions (ie including proposed Duralie movements), indicates that existing noise levels would increase only marginally (<1 dBA) and still meet the EPA's 60 dBA criterion at a distance of 25 m.

c. The predicted maximum (L_{Amax}) noise emission level of 84 dBA at 25 m from the proposed Duralie train movements complies with the 85 dBA criterion.

d. The predicted maximum (L_{Amax}) noise emission of 89 dBA at 25 m from the existing passenger train movements may moderately exceed the 85 dBA criterion, however this situation is outside the control or responsibility of the proponent.

It is concluded that the average traffic and peak traffic $L_{Aeq(24hour)}$ noise emissions arising from the predicted total train movements (ie existing and proposed Duralie movements) comply with the EPA's recommended 60 dBA $L_{Aeq(24hour)}$ noise criterion at a distance of 25 m. In addition, the predicted maximum (L_{Amax}) noise emission from the proposed Duralie train movements complies with the EPA's 85 dBA criterion.

Furthermore, noise emissions from the additional train movements would increase existing train noise levels in the vicinity of the railway only marginally (1 dBA) producing a negligible impact on existing receivers.

8 SUMMARY OF FINDINGS

This report presents the results and findings of a preliminary noise impact assessment of proposed operating variations at Stratford Coal Mine involving the rail transportation of ROM coal from the Duralie Coal Mine for processing at Stratford. The following information is concluded:

Rail Unloading Facility Noise Impact Assessment

- Existing rail loading and proposed rail unloading operations can not occur simultaneously, therefore it is not necessary to consider cumulative noise impacts. However, train operation (ie rail loading or rail unloading) will occur at twice the current frequency with up to eight train movements per day.
- The total overall sound power level of the existing rail loading facility is 121 dBA, similarly the total overall sound power level of the proposed rail unloading facility is 121 dBA.
- It is reasonable to assume that noise emissions from the proposed rail unloading facility (radial stockpile) would be equivalent or only marginally less than the existing rail loading facility as the dozer would operate (as required) on the radial stockpile (maximum 9 m) which is well below the elevation of the product stockpile (maximum 20 m).
- Existing train loading noise emissions (ie train loading, wagon and locomotive noise) at BG4 Bagnall (and BG4A Bramley) are clearly discernible from other mine generated noise emissions, where the maximum recorded $L_{A10(15minute)}$ noise level is 45 dBA.
- In view of the proposed doubling in train operations (ie train loading or train unloading) then noise emissions in order of 40 dBA to 45 dBA are likely to occur at approximately twice the current frequency at BG4 Bagnall (and BG4A Bramley).

Overall Mine Noise Impact Assessment

- The total overall sound power level of the existing 3.4 Mtpa/1.7 Mtpa mining operation (including rail loading) is 136 dBA.

- The total overall sound power level of the proposed 2.1 Mtpa/1.7 Mtpa mining operation (including rail loading or rail unloading) is 136 dBA.
- It is concluded that overall magnitude mine noise emission levels will remain unchanged as a result of the proposed operating variations.

Rail Transportation Noise Impact Assessment

- It is concluded that the average traffic and peak traffic $L_{Aeq(24hour)}$ noise emissions arising from the predicted total train movements (ie existing and proposed Duralie movements) comply with the EPA's recommended 60 dBA $L_{Aeq(24hour)}$ noise criterion at a distance of 25 m. In addition, the predicted maximum (L_{Amax}) noise emission from the proposed Duralie train movements complies with the EPA's 85 dBA criterion.

- Furthermore, noise emissions from the additional train movements would increase existing train noise levels in the vicinity of the railway only marginally (1 dBA) producing a negligible impact on existing receivers.

Appendix A

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DEVELOPMENT CONSENT CONDITIONS

DETERMINATION OF DEVELOPMENT APPLICATION PURSUANT TO SECTION 101

I, the Minister for Planning, pursuant to Section 101 of the Environmental Planning and Assessment Act, 1979 ("the Act") determine the development application ("the application") referred to in Schedule 1 by granting consent to the application subject to the conditions set out in Schedule 2.

The reasons for the imposition of the conditions are:

(i) to minimise the adverse impact the development may cause through noise, visual disturbance, air and water pollution;

(ii) to provide for environmental monitoring and reporting;

(iii) to set requirements for infrastructure provision.

Robert Webster
Minister for Planning

Sydney, 19/12/1994 File No. N93/422/001

Schedule 1

Application made by:	Stratford Coal Pty Limited ("the Applicant").
To:	Gloucester Council (DA 73/94) ("the Council").
In respect of:	Authorisations ATP 311, 315 on land described in Attachment "A".
For the following:	Construction and operation of a surface coal mine and associated facilities ("the development).
NOTE:	1) To ascertain the date upon which the consent becomes effective, refer to Section 101(9) of the Act. 2) To ascertain the date upon which the consent is liable to lapse, refer to Section 99 of the Act.

SCHEDULE 2

General

1. The Development is to be carried out generally in accordance with the Environmental Impact Statement dated 12 September 1994 and prepared by Peter Anthony Ryan and Christopher Julian Raymond Ellis certified in accordance with Section 77(3) of the Act, or as may be modified by the conditions set out herein.

Duration

2. This consent is limited to a period of 14 years from the date of a grant of mining lease in respect of the development.

Statutory Requirements

3. The Applicant shall ensure that all statutory requirements including but not restricted to those set down by the Local Government Act, 1993, Pollution Control Act, 1970, Clean Air Act, 1961, Clean Water Act, 1970, Noise Control Act, 1975, Protection of the Environment Administration Act. 1991 and all other relevant legislation, Regulations, Australian Standards, Codes, Guidelines and Notices as well as the requirements of the Environment Protection Authority ("EPA"), Department of Mineral Resources ("DMR"), National Parks and Wildlife Service ("NPWS"), Department of Conservation and Land Management ("CaLM"), Roads and Traffic Authority ("RTA"), Department of Water Resources ("DWR"), and State Rail Authority are fully met.

Noise

4. The Applicant shall:

   i) measure and record the L_A10,15 min noise level over a minimum 72 hour period at the Perrin, Isaacs, Atkins, Fragley properties and other locations specified by EPA, during normal operation of the mine, on a quarterly basis such that the 40dB(A) day time and 35dB(A) night time noise levels are able to be presented in respect of the mine site and surrounding area, or as otherwise required by EPA.

   ii) submit a management plan for information of Gloucester Council ("Council") and approval by EPA, giving noise safeguards and procedures for dealing with noise episodes which exceed the above L_A10 noise levels, as required by EPA.

   iii) institute appropriate noise attenuation measures, to the satisfaction of the EPA, to ensure the residents of the Fragley residence are not subject to offensive noise emitted from the mine.

Blasting

5. The Applicant shall:

i) ensure that blasting practice is generally carried out in accordance with the recommendations of Australian Standard AS-2187-1993 and in terms of ANZEC Guidelines.

ii) design all blasts based on the results of monitored blasts designed to minimise air blast overpressure and ground vibration using the Nonel or equivalent system such that any one blast has less than a five (5) per cent probability of exceeding an air blast overpressure of 115dBA and vibration with a peak particle velocity of 5mm/sec at the closest residence outside the mining lease.

iii) determine appropriate weather data by taking measurements immediately prior to blasting and from the data shall predict whether noise levels outside the mine site are likely to be increased above the levels expected under neutral meteorological conditions. The data shall be recorded by the Applicant as part of its monitoring data.

iv) not blast if the predictions in sub-clause (iii) herein indicate that noise goals are likely to be exceeded or as otherwise advised by EPA.

v) monitor all blasts and record the overpressure and peak particle velocity at the Isaac and Fragley residences and other locations specified by EPA and the DMR.

vi) consult with residents whose properties are adjoining or adjacent to the development, with a view to determining the most reasonable and appropriate blasting times for the development. The Applicant shall give reasonable notice of proposed blasting times.

(vii) not blast when wind speed and direction is likely to carry dust onto adjoining properties or when wind speed is greater than 10 metres per second.

(viii) avoid blasting as far as practicable in the construction of the railway underpass.

(x) in the event of damage occurring to any properties or structures as a result of blasting at the mine site, be responsible for rectifying the damage to the satisfaction of the effected property owner and at the cost of the applicant.

(xi) not blast outside daylight hours.

Air Quality

6. The Applicant shall:

i) install and utilise a meteorological monitoring station, provide representative data for the mine site, rural and residential properties which adjoin or are adjacent, and the village of Stratford. Such station shall be installed as specified by and to the satisfaction of the EPA.

ii) relate the meteorological data and characterisation to proposed schedules of mining operations, to minimise the potential for dust emission.

iii) install dust deposition gauges and in each calendar month shall determine the dust deposition rate in gm/m^2/month at Perrin, Blanch, Isaacs, Atkins, Van der Drift properties and other locations specified by the EPA.

iv) continue meteorological monitoring as well as the monitoring of dust deposition rates and concentrations of total suspended particulates for the life of the mine subject to sub-clause (i).

v) have two (2) high volume air samplers equipped to sample particles of less than 10 microns located in positions approved by the EPA. Sampling is to be undertaken on a 24hr 6 days per week cycle with averaging periods (annual means) as well as monitoring equipment/procedures to follow AS2724.3.

vi) provide to the EPA and Council results and analysis of air quality monitoring on an agreed basis, and in the annual report (Condition 26).

vii) cease mining operations at any time when the driver visibility or traffic safety on Bucketts Way is adversely affected by dust from the site.

viii) submit within 14 days of any dust episodes affecting residences, management plans for approval by the Mines Inspector giving air quality safeguards and operational procedures for dealing with such dust episodes.

ix) implement the management plan in (viii) above if the Mines Inspector is satisfied that adequate measures have been incorporated in the plan to minimise the occurrence and intensity of episodes of wind blown dust in adverse meteorological conditions.

Dust Suppression

7. The Applicant shall:

i) maintain sufficient equipment with the capacity to apply water to all unsealed trafficked areas at the rate of at least one litre per square metre per hour or apply an equally effective dust suppressant;

ii) ensure the prompt rehabilitation of all disturbed areas to minimise the generation of wind erosion dust, in accordance with the requirements of DMR;

iii) install automatic water sprays on the coal stockpiles such that the stockpiles are sprayed when the wind speed from any direction exceeds 5.6m/s.

Coal Washery Rejects Disposal

8. The Applicant shall

i) meet the requirements of the DMR in respect to the disposal of coal washery rejects.

ii) dispose of fine rejects with coarse rejects, or otherwise only with the consent of Council and the approval of DMR.

Complaints

9. The Applicant shall:

i) employ a person responsible for acting immediately on noise and dust complaints as a result of mining operations on a 24-hours per day, 7 days per week basis.

ii) install a telephone line dedicated to receiving noise and dust complaints and advertise the number publicly.

iii) maintain a record of all noise and dust complaints and of the actions taken to control and mitigate all such complaints. A copy of the record shall be forwarded to Council fourteen days before the end of the month for public information.

Water Management

10. The Applicant shall prepare a detailed water management plan for the site. The plan shall be submitted to DWR for information and approval of EPA prior to mining operations commencing on the site. The plan shall address the following matters:

i) the quality and quantity of discharge from the site;

ii) stormwater management within the site;

iii) the quality of water in Avondale Swamp, Avondale Creek, Dogtrap Creek or the Avon River or other drainage paths from the mine such that waters shall maintain water quality within EPA water quality objectives in relation to any discharge from the mine site:

iv) investigate possible adverse effects on water supply sources of surrounding landholders as a result of the mining operations:

v) the long term treatment of groundwater accessions to any final voids.

vi) ensure that the capacity of mine water storage dams are such as to obviate the need for discharge. If it is found that a discharge of mine water may be necessary, the Applicant shall investigate and where feasible implement options other than discharge. Any discharge shall comply with the water quality criteria applied by the EPA under a Pollution Control licence.

vii) establish a water monitoring program for the information of Council and to the satisfaction of EPA and DWR and including Atkins, Ellis and Bramley properties.

Groundwater Quality

11. The Applicant shall:

i) consult with EPA, DWR, CaLM, and the Avon Valley Land Care Group to define measures necessary to control salinity impacts to groundwater, strategies to minimise dryland salinity and re-establishment of water tables.

ii) monitor existing groundwater bores now rated by Council in the Village of Stratford and other bores licenced by DWR in the vicinity; and

iii) in the event of any adverse impact to the water quality or reduction in levels of these bores attributable to mining, notify DWR, carry out remedial measures as specified by DWR and at the Applicant's own cost.

Aboriginal Sites

12. The Applicant shall:

i) ensure protection of the Aboriginal artefact scatter No. 38.1.8 to the satisfaction of NPWS.

ii) monitor topsoil removal and immediately advise NPWS if aboriginal artefacts are found or observed and meet NPWS requirements.

Land Acquisition .

13. The Applicant shall:

i) in the event that the impact of dust or noise from the mining operations at residences in the vicinity of Stratford is in excess of the amenity criteria of EPA, undertake such works or change mining practices so as to meet EPA's criteria. In the event that EPA subsequently ascertains that such works or changes to mining practices have not resulted in compliance with its criteria, purchase the affected land if requested to do so by the property owners on the basis of a mutually agreed acquisition price or by reference to clauses below.

ii) In respect of a request to purchase land arising under subclause (i), the Applicant shall pay the owners a fair and reasonable acquisition price which shall take into account and provide payment for:

a) a sum not less than the current market value of the owner's interest in the land having regard to the existing use of the land whosoever is the occupier and all improvements thereon immediately prior to the granting of this consent as if the land was unaffected by the development proposal. The provisions of this subclause do not apply to the holder of an authority under the Mining Act, 1992.

b) the owners reasonable compensation for disturbance allowance and relocation costs within the Local Government Area of Gloucester.

c) current market value as defined in Section 70 of the Land Valuation Act;

d) the owners reasonable costs for obtaining legal advice and expert witnesses for the purposes of determining the acquisition price of the land and the terms upon which it is to be acquired.

iii) In the event that the Applicant and any owner referred to in subclause (i) herein cannot agree within the time limit upon the acquisition price of the land and/or the terms upon which it is to be acquired, then:

a) either party may refer the matter to the Director who shall request the President for the time being of the Australian Institute of Valuers and Land Economists to appoint an

independent valuer a Fellow of the Institute, who shall determine after consideration of any submissions from the owners a fair and reasonable acquisition price as described and referred to in subclause (ii) herein.

b) in the event of a dispute regarding outstanding matters that cannot be resolved, the independent valuer shall refer the matter to the Director, recommending the appointment of a qualified panel. The Director, if satisfied that there is need for a qualified panel, shall arrange for the constitution of the panel. The panel shall consist of:

1) the appointed independent valuer.

2) the Director, or her nominee.

and/or

3) the President of the Law Society of NSW or his nominee.

The qualified panel shall determine:

A fair and reasonable acquisition price as described and referred to in Clause (ii).

c) The Applicant shall bear the costs of any valuation or survey assessment requested by the Director in accordance with subclauses (a) and (b) herein.

d) Upon receipt of a valuation arising pursuant to subclauses (a) and (b) herein, the Applicant shall offer to acquire the relevant land at a price not less than the said valuation. Should be Applicant's offer to acquire not be accepted by an owner within six months of the date of such offer, the Applicant's obligations to such owner pursuant to this Clause shall cease.

e) Upon settlement of the acquisition referred to in this Clause the Applicant shall also pay to the owner the costs and compensation assessed pursuant to subclause (iii) herein including the owner's reasonable costs in the event of a subdivision.

<u>Department of Conservation and Land Management</u>

14. Land Management Plan
The Applicant shall:

i) prepare and regularly update at its own expense, to the satisfaction of CaLM, a Land Management Plan for all its landholdings to

provide for proper land management, according to objects of land care.

ii) prepare a design report for the eastern diversion which is to be submitted to CaLM and DWR for approval prior to commencement of work.

Coal Transport

15. The Applicant shall transport bulk samples and product coal from the site to the Port of Newcastle and regional customers by rail.

Road works

16. The Applicant shall:

i) construct the intersection of Bucketts Way and the proposed access point to the mine service road with a type C intersection. Fully detailed engineering plans in respect to this intersection shall be submitted to Council and the RTA for approval prior to work commencing. The intersection shall be completed within six weeks of the commencement of construction.

ii) ensure that the first 500m of the internal service road is sealed prior to the commencement of mining. During the two years immediately after the commencement of mining, monitor dust near the service road, and determine, with advice of the community consultative committee, whether sealing of the remainder of the road is necessary.

iii) restrict all traffic to the mine (including construction traffic) to the new service road.

iv) undertake at no cost to Council the closure of Parkers Road as determined by Council.

v) undertake the necessary steps to divert that section of Bowens Road which will be subject to mining and divert Bowens Road and dedicate the land upon which the road is diverted as a public road.

vi) submit detailed engineering plans in respect to the construction work involved in the diversion of Bowens Road for the approval of Council prior to the commencement of construction.

vii) ensure Bowens Road diversion is completed prior to mining of the existing road.

viii) meet the costs involved in the diversion of Bowens Road including legal and survey costs for the closure of part of Bowens Road and the dedication of a new section of road as a public road.

ix) ensure a full sight distance over the proposed railway underpass and an adequate stopping distance for 100 kph traffic. The lane width of the bridge shall be a minimum of 3.5 metres and shoulder width a minimum of 2 metres.

x) submit detailed engineering design plans for the railway bridge for the approval of the Council, RTA and State Rail Authority, and provide design details on any diversion required in Bucketts Way, as a result of the underpass construction.

xi) pay a contribution of $20,000 to Council prior to the commencement of site works, for the upgrading of the northern approach to Broad Gully Bridge on Bucketts Way.

xii) prepare all engineering plans in accordance with the following:

a) plans to be endorsed by suitably qualified engineer,

b) construction to be supervised by suitably qualified engineer,

c) works as executed to be endorsed by the supervising engineer and submitted to Council,

d) all construction to be in accordance with RTA or Council's design standards and approved by the RTA or Council prior to work commencing.

Landscaping

17. The Applicant shall:

i) within three months of the date of this consent or within such further period as Council may permit, submit for Council's approval:

a) A detailed landscaping plan covering all areas identified as necessary for the maintenance of satisfactory visual amenity. The Applicant shall engage a suitably qualified person to assist in preparing the landscaping plan. The plan shall provide for the establishment of trees and shrubs and the construction of mounding or bunding.

b) Details of the visual appearance of all buildings, structures, facilities or works (including paint colours and specifications). Buildings and structures shall be designed and constructed/renovated so as to present a neat and orderly

appearance and to blend as far as possible with the surrounding landscape.

c) A comprehensive plan of landscape management which shall include detailed plans, specifications and staged work programs to be undertaken, maintenance of all landscape works and maintenance of building materials and cladding.

ii) within six months of this consent, construct suitable bunding and plant trees to screen Bucketts Way, to the satisfaction of Council.

iii) undertake the following specific works, prior to mining and specify in the plan referred to in (i) above:

- forward tree planting along the northern side of Parkers Road as an extension to the existing plantings. Additional planting is to be undertaken amongst the tree groves established in 1982 parallel to Bucketts Way.
- forward tree planting parallel to Bowens Road.
- tree planting parallel to Wenham Cox Road to minimise visual impact to the "Avondale" property.
- bunding around the preparation plant and coal washery rejects disposal areas.
- tree planting of the southern slopes of the bund wall adjacent to Parkers Road.

iv) apply to landscaping areas exposed for 30 days or more a surface sealant, such as bitumen emulsion, straw or seed as may be directed by CaLM.

v) comply with the requirements of Council in respect to any supplementary tree planting and visual amenity enhancement works within or immediately outside the mining lease area which may be identified by the Council as necessary for the maintenance of satisfactory visual amenity in the local area.

Rehabilitation

18. The Applicant shall carry out rehabilitation of all mine areas in accordance with the requirements and conditions of the Open Cut Approval of the DMR.

Community Consultative Committee

19. The Applicant shall:

i) participate and co-operate in the establishment by the Council of a Community Consultative Committee to monitor compliance with conditions of this consent during the term of the development. The Chairman, provided from the Council, shall convene representatives of the Applicant (2), representatives of landowners (3), Council (2), community groups (2) and government agencies (DMR, DWR, EPA, CaLM) as required in the event of unresolved issues. The Committee shall report to both the Council and the Applicant to bring to their respective attention matters related to the environmental performance of the development.

ii) The Applicant shall at its own expense:

a) nominate 2 representatives to attend all meetings of the Committee;

b) provide to the Committee the monitoring data as part of a report which includes interpretation and discussion by a suitably qualified person;

c) promptly provide to the Committee such other information as the Chairman of the Committee may reasonably request concerning the environmental performance of the development;

d) provide an Annual Report to all members of the Committee detailing the measures the Applicant has adopted and the resources the Applicant has utilised over the preceding 12 months to ensure compliance with monitoring conditions:

e) routinely provide wind data, results of dust and noise/vibration monitoring programs and the surface/groundwater monitoring program to all members of the Committee ; and

f) reimburse the Council and `citizen' members of the Committee for all reasonable expenses incurred in attending and in the case of the Council arranging and conducting Committee meetings and Committee site inspections, as may be required.

Environmental Officer

20. The Applicant shall appoint an Environmental Officer whose qualifications are acceptable to the Department of Mineral Resources to be responsible for ensuring that all environmental safeguards proposed for the development and as required by this consent and other statutory approvals, are followed and monitored from the commencement of construction.

Flora and Fauna

21. The Applicant shall:

i) prior to the commencement of mining in consultation with NPWS and CaLM, develop a plan of management in relation to the establishment of the Wildlife Corridor as proposed in the EIS. The plan of management will, amongst other things, identify the stages and timing of stages of the corridor.

ii) undertake additional bat surveys in spring and summer (prior to the commencement of mining operations) and to ensure the proposed ameliorative measures as described in page 12 of appendix 8.2(b) of the EIS are implemented.

iii) undertake additional surveys of the Green and Gold Bell Frog and the Green Thighed Frog immediately following rain. Amelioration measures as described in section R3, 4.4 and 5.5 of appendix 8.2(a) of the EIS shall be implemented if these species are detected.

iv) ensure the remnant area of vegetation of the Squirrel Glider habitat shall be protected from development.

v) protect all additional areas of remnant vegetation and include these areas in the wildlife corridor.

vi) in addition to the proposed monitoring of waterways, undertake a program of indicative biological monitoring within the colliery holding and in its proximity.

Financial Contribution

22. The Applicant shall:

i) prior to the commencement of any work on site pay an initial developer contribution to the Council of $150,000.

ii) pay a community infrastructure contribution of $56,000 per annum (payable quarterly and indexed to CPI Sydney [all groups] Index) to the Council, commencing on the anniversary of the first contract coal shipment or 1 July, 1996 whichever is the earlier.

Rental Housing

23. The Applicant shall:

i) investigate the availability of short-term rental accommodation prior to the arrival of the construction workforce, and liaise with the

Gloucester Council to establish a register of available short-term accommodation for the use of construction workforce on arrival: and

ii) liaise with the Gloucester Council to monitor local housing demand during the construction stage of the project and in the event of a shortage of rental accommodation at any stage liaise with the Council. with a view to provide other temporary accommodation facilities for use by the workforce.

Flood lighting

24. The Applicant shall screen all on-site flood lighting and vehicular lights within the development to the satisfaction of the Council.

Fire Protection

25. The Applicant shall:

i) provide adequate fire protection works on site to include one fully equipped fire fighting unit on stand-by or alternative facilities specified by the Council.

ii) undertake annual hazard reduction works in accordance with Council's Bushfire Management Plan.

Final Void

26. The Applicant shall, upon the second open cut approval made by the DMR discuss use of the final void with Council.

Report

27. The Applicant shall:

i) prepare and submit to DMR for approval an annual Environmental Management Plan Report. The report shall include:

a) short. medium and long-term mining plans:

b) rehabilitation report in respect of open cut operations:

c) a review of effectiveness of environmental management of the colliery holding in relation to EPA and DWR requirements:

d) a review of performance in terms of the conditions of development consent:

e) a listing of any variations obtained to approvals applicable to the mine during the previous year:

f) the outcome of the water budget for the year, the quantity of clean water used from water storages, and detailed data of the disposal of any contaminated water into water courses.

ii) - consult with the Director during report preparation concerning any additional requirements.

iii) ensure that copies of the annual Environmental Management Plan Report are submitted to the Director, EPA, CaLM, DWR, DMR, NPWS, Council and the Community Consultative Committee and be available for public inspection at the Council.

iv) ensure that the first report is completed and submitted within twelve months of this consent, at a date to be determined in consultation with DMR, and thereafter annually on the anniversary of that date.

Dispute Resolution

28. In the event that the applicant and the Council or a Government body other than the Department, cannot agree on the specification or requirements applicable under this consent, other than provided in Condition 14, the matter shall be referred by either party to the Director or if not resolved, to the Minister, whose determination of the disagreement shall be final and binding on the parties.

Note: This approval does not relieve the Applicant of the obligation to obtain any other approval under the Local Government Act, 1993 as amended, the Ordinance made thereunder including approval of building plans, or any other Act.

ATTACHMENT "A"

LAND DESCRIPTION

Crown Grant Volume 13945 Folio 25 Lot 2 in DP 241780 Parish of Avon County of Gloucester

Block 70 of Avon Subdivision Parish of Avon County of Gloucester - Registered No. 108 Book 3445

Part Lot 69 Avon Subdivision Parish of Avon County of Gloucester - Registered No. 964 Book 3568

Lots 57, 58 and 59 of Avon Subdivision Parish of Avon County of Gloucester - Registered No. 458 Book 3569

Block 74 in Avon Subdivision Parish of Avon County of Gloucester - Registered No. 73 Book 3570

Lot 76 of Avon Subdivision Parish of Avon County of Gloucester - Registered No. 419 Book 3568

Lots 45, 56A, 56B and 56C of Avon Subdivision Parish of Avon County of Gloucester - Registered No. 420 Book 3568

Lot 41 of Avon Subdivision Parish of Avon County of Gloucester - Registered No. 418 Book 3568

Lot 1 in DP 241780 Volume 13784 Folio 164 Parish of Avon County of Gloucester

Part Lot 53 of Avon Subdivision Parish of Avon County of Gloucester - Registered No. 966 Book 3568

Lot 71 of Avon Subdivision Parish of Avon County of Gloucester - Registered No. 965 Book 3568

Lot 1 in DP531023 Certificate of Title Volume 15207 Folio 225 Parish of Avon County of Gloucester

Lots 54, 55, 56D, 56E, 72, 73 and 75 of Avon Subdivision Parish of Avon County of Gloucester - Registered No. 625 Book 3569

Lots 60 and 61 Parish of Avon County of Gloucester - Registered No. 208 Book 3559

Part of Lots 52 and 53 of Avon Subdivision Parish of Avon County of Gloucester

1/194827 Lot 1 in DP 194827 Parish of Avon County of Gloucester

52/979859 Lot 52 in DP 979859 Parish of Avon County of Gloucester

Lot 64 in DP979859 Certificate of Title 64 979859 Parish of Avon County of Gloucester

ENVIRONMENTAL PLANNING AND ASSESSMENT ACT 1979

Notice of Modification Pursuant to Section 102 of the Environmental Planning and Assessment Act 1979 of a Development Consent Granted Under Section 101 of the Act.

I, the Minister for Urban Affairs and Planning, pursuant to section 102 of the Environmental Planning and Assessment Act 1979, being satisfied that the development to which the modified development consent will relate is substantially the same development, and that there is no objector to the original development application that will be prejudiced, modify the consent referred to in Schedule 1 as set out in Schedule 2. (N93/00422/003)

Craig Knowles
Minister for Urban Affairs and Planning

Sydney, 17/1/ 1996

SCHEDULE 1

Consent granted by the Minister for Planning on 19 December 1994 in respect of a development application made by Stratford Coal Pty Ltd to Gloucester Shire Council for the construction and operation of a surface coal mine and associated facilities on land known as Authorisations ATP 311, 315 (see Attachment 'A').

SCHEDULE 2

The development consent is modified by:

(a) deleting Condition 1 and inserting instead:

General

1. The development is to be carried out generally in accordance with the Environmental Impact Statement dated 12 September 1994 and prepared by Peter Anthony Ryan and Christopher Julian Raymond Ellis certified in accordance with section 77(3) of the Act, as modified by the application to vary development consent dated 24 April 1996 and information contained in the letter and supporting information from the applicant dated 20 April 1996, including the following reports:

- Proposal to Increase Saleable Coal Production to 1.7 Mtpa -Stratford Coal Pty Ltd, April 1996
- Roseville Mine Plan - MineConsult (Job No. 1200), February 1996
- Proposed Production Variation - Assessment of Noise Emissions, Stratford Coal Project, Stratford NSW - Richard Heggie Associates Pty Ltd (Report 5083-R6), 19 April 1996
- Amendment to Assessment of Noise Emissions - Roseville Pit, Stratford Coal Project, Stratford NSW - Richard Heggie and Associates Pty Ltd, 19 July 1996
- Stratford Coal Mine Proposed Production Variation - Assessment of Water Balance and Management Plan - Woodward-Clyde (Project No. A3200569/1) April 1996.

or as may be modified by the conditions set out herein.

(b) inserting in Condition 4 the following:

iv) prepare, in consultation with the EPA, and to the satisfaction of the EPA, a noise reduction program detailing an on going program of investigation and implementation of noise reduction measures.

(c) inserting after Condition 4 the following:

Hours of Operation for Roseville Pit

4A. All activities associated with construction and operation of the Roseville pit shall be confined to the hours between 7:00am and 10:00 pm.

(d) inserting after Condition 10 the following:

Land and Water Management for the Roseville Pit

10A. The applicant shall prepare a land and water management plan in liaison with, and to the satisfaction of, the Department of Land and Water Conservation, prior to commencement of construction. The plan shall include details of:

i) the uncontaminated water diversion system;

ii) contingency arrangements in the event that a discharge of water from the site is required; and

iii) erosion and sediment controls.

(e) inserting in Condition 11 the following:

iv) prior to commencement of construction of the Roseville pit, liaise with the Department of Land and Water Conservation on the installation of groundwater monitoring bores. The number, location and depth of such bores shall be determined by DLWC.

(f) re-numbering Condition 18 as Condition 18(i) and inserting after it the following:

ii) The applicant shall provide details of soil tests on topsoil and subsoil samples from the Roseville pit site and forward the results of such tests to the Department of Land and Water Conservation. The applicant shall liaise with DLWC on the need for any required treatment for sodicity, salinity or pH problems.

(g) deleting Condition 22 (ii) and replacing it with the following:

ii) pay a community infrastructure contribution of $86,000 per annum (payable quarterly and indexed to CPI Sydney [all groups] index) to the Council, commencing on the anniversary of the first contract coal shipment or 1 July 1996, whichever is the earlier.

(h) inserting in Condition 22 the following:

iii) prior to commencement of any increase in coal production associated with the application to modify development consent dated 24 April 1996, pay a developer contribution to Council of $66,000.

EPA POLLUTION CONTROL APPROVAL 001495

ENVIRONMENT PROTECTION AUTHORITY (EPA)

POLLUTION CONTROL ACT, 1970

Pollution Control Approval

Approval Number : 001495

File Number : 2722342234

Date of application : 20 December, 1994

Date of issue : 6 January, 1995

Approval is hereby given to : STRATFORD COAL PTY LTD

of : GPO BOX 2587
SYDNEY
NSW 2001

under the provisions of Section 17K of the Pollution Control Act, 1970 to carry out the following work : Development of open-cut coal mine, coal preparation plant & handling facilities

For stage number : 001

single stage

at : STRATFORD COAL PTY LTD
WOOD STREET
STRATFORD VIA GLOUCESTER
NSW 2422

subject to the following conditions:

CATEGORY I

1 The work must be carried out in accordance with this approval and in accordance with the information supplied in the application dated 20 December, 1994 and with any supplementary documentation which has been supplied to support the application.

2 Roofwater and stormwater from uncontaminated areas must be drained direct to the stormwater drainage system.

3 Sediment control facilities must be installed before any construction takes place.

4. To minimise dust emissions temporary roads for soil or raw material haulage must be surfaced with selected materials. Soft mud stone, clay stone and shale must not be used.

5 Guide posts and/or other control measures used to define trafficable areas must be maintained to prevent traffic movement onto unsealed areas of the premises.

6 The raw coal dump station must be fitted with an automatically activated dust suppression water spray system.

7 Belt conveyors, other than those whose functions preclude it, must be enclosed on the top and at least one side. Belt scrapers must be installed to effectively remove coal from the underside of each belt.

8 Conveyor transfer points must incorporate an effective water spray dust suppression system. The system must operate automatically whenever the conveyor system is activated.

9 Where open stockpiles of fine materials of 5mm or less are used, an effective water spray sprinkler system must be installed and operated at a frequency to keep the entire surface of the stockpiles sufficiently damp at all times, to prevent the entrainment of dust particles into the atmosphere.

10 Bulk storage tanks containing fuel and oil must be provided with bunds constructed of impervious materials and must be of sufficient size to contain 110 % volume of the storage tanks. Walls must be not less than 250 millimetres high.

11 An area must be provided for the disposal, on-site, of treated effluent from the sewage treatment plant. The design of the system and sizing of the disposal area must be in accordance with the EPA's draft guideline "Utilisation of Treated Effluent by Irrigation".

12 Equipment must be provided to ensure there is no visible oil and/or grease in the waters discharged from the site or to any natural watercourse.

CATEGORY II

13 The applicant must certify, by means of the form titled Certificate of Compliance with Pollution Control Approval -

13.1 the extent to which the conditions under Category I and any requirements as specified in subsequent correspondence between applicant and the EPA have been complied with; and
13.2 identify any conditions not complied with; and
13.3 the reasons for any non compliance referred to in paragraph 13.2.

The applicant must forward the completed form to the EPA within

fourteen days of the completion of the work and/or before the plant, equipment or construction is put into regular operation.

NEIL SHEPHERD
Director-General

Per ....C.J.Halverson.....
Colin Halverson
Head, Regional Operations Unit
HUNTER
(by Authorisation)

ENVIRONMENT PROTECTION AUTHORITY
NEW SOUTH WALES
Pollution Control Act, 1970.

LICENCE

Licence Number: 005161
File Number: 272234/B01
In Force From: 30 June, 1997
In Force Until: 30 June, 1998

Name and Address of Licensee:
STRATFORD COAL PTY LTD
P.O. BOX 168
GLOUCESTER NSW 2422

Name and Address of Premises, the subject of this Licence:
STRATFORD COAL MINE (MINING LEASE 1360)
MINING LEASE 1360 OFF WOOD STREET
STRATFORD NSW 2422

This licence under the Pollution Control Act 1970 ("the Act") is granted to: STRATFORD COAL PTY LTD ("the licensee") in respect of premises situated at: MINING LEASE 1360 OFF WOOD STREET, STRATFORD ("the premises") subject to the conditions specified below:

Other than in accordance with section 17B of the Act this licence is not transferable.

The conditions of this licence may be varied or revoked, or new conditions attached, at any time by notice in writing given to the licensee.

DEFINITIONS
In this licence except in so far as the context or subject matter otherwise indicates or requires -
"EPA" means the Environment Protection Authority.

"regional office" means
Environment Protection Authority
HUNTER Regional Office
NSW GOVERNMENT OFFICES, 117 BULL STREET
NEWCASTLE WEST NSW 2302
Phone (049) 26 9971 Fax (049) 29 6712
After Hours 131 555

Postal Address
P O BOX 488G
NEWCASTLE NSW 2300

"environment" includes all aspects of the surroundings of human beings, including:
(a) the physical factors of those surroundings, such as the land, the waters and the atmosphere; and
(b) the biological factors of those surroundings, such as the animals, plants and other forms of life; and
(c) the aesthetic factors of those surroundings, such as their appearance, sounds, smells, tastes and textures.

Licence Number: 005161 In Force Until: 30 June, 1998

"harm" in relation to the environment, includes any direct or indirect alteration to the environment that has the effect of degrading the environment and, without limiting the generality of the foregoing, includes:

(a) any act or omission that results in air pollution, within the meaning of the Clean Air Act 1961; and

(b) any act or omission that results in the pollution of any water, within the meaning of the Clean Waters Act 1970.

"dry weather conditions" means less than ten millimetres of rain falling within a 24 hour period.

Pollution of waters

S1. The licensee must not pollute waters except as expressly permitted by this licence. (That is, the defence in section 16 (6) of the Clean Waters Act 1970 is available only if the licensee pollutes waters as expressly permitted by this licence.)

In this condition, the terms "pollute" and "waters" have the same meaning as in the Clean Waters Act 1970.

Activities must be carried out competently

S2. All activities carried out on the premises must be carried out in a competent manner.

In this condition, "activities" includes:

(a) the processing, handling, movement and storage of materials and substances; and

(b) the treatment, storage and disposal of wastes (including solid and liquid wastes).

Maintenance of plant and equipment

S3. All plant and equipment installed or used in or on the premises:

(a) must be maintained in a proper and efficient condition; and

(b) must be operated in a proper and efficient manner.

In this condition, "plant and equipment" includes drainage systems, infrastructure, pollution control equipment and fuel burning equipment.

Testing methods

S4. Any monitoring required by this licence must be carried out:

(a) in accordance with any relevant testing methods set out in the Clean Air Regulations 1964, the Clean Waters Regulations 1972 or the Noise Control Regulation 1975; or

(b) in accordance with any method set out in any condition of this licence; or

(c) if no compulsory method is set out in those Regulations or in this licence, in a manner approved by the EPA in writing before any tests are conducted.

Record of pollution complaints

5.1 The licensee must keep a legible record of all complaints received by the licensee or by any employee or agent of the licensee, in relation to pollution from or on the premises.

5.2 The record must include details of the following:

(a) the date and time of the complaint;

(b) the method by which the complaint was lodged;

(c) any personal details of the complainant which were provided by the complainant or, if no such details were provided, a note to that effect;

(d) the nature of the complaint;

(e) the action taken by the licensee in relation to the complaint, including any follow-up contact with the complainant.

S5.3 The record of each complaint must be kept for at least 2 years after the complaint was received.

S5.4 The records must be produced to any officer of the EPA who asks to see them.

Records

S6.1 The results of any monitoring required by this licence must be recorded.

S6.2 All records required to be kept by this licence must be kept in a legible form or in a form that can readily be reduced to a legible form.

S6.3 The records must be kept for at least 3 years after the monitoring or event to which they relate took place.

S6.4 The records must be produced in a legible form to any officer of the EPA who asks to see them.

Reporting of environmental harm

S7.1 If anything happens on the premises that has caused, is causing or is likely to cause harm to the environment, whether the harm occurs on or off the premises, the licensee must report the event to the EPA as soon as practicable after it becomes known to the licensee or to one of the licensee's employees or agents.

Licence Number: 005161 In Force Until: 30 June, 1998

S7.2 The event must be reported by telephoning:
(a) the regional office of the EPA on the phone number specified on the front of this licence, if the event is reported during office hours;
(b) the after hours telephone number specified on the front of this licence, if after office hours;
(c) in the event that an EPA officer cannot be contacted at either of those numbers, the EPA's "Pollution Line" service on 131 555.

S7.3 This condition does not apply when the harm caused or likely to be caused to the environment is expressly permitted by this licence.

Written report

S8.1 The EPA may make a written request that the licensee prepare a written report of any event on the premises that, in the opinion of the EPA, has caused, is causing or is likely to cause harm to the environment, whether the harm occurs on or off the premises.

S8.2 The licensee must make all reasonable inquiries in relation to the event and supply the report to the EPA within 21 days of the request, or within such shorter time as may be specified in the request.

S8.3 The report must include the following information:
(a) all details known to the licensee of the cause, time and duration of the event;
(b) all details known to the licensee of the type, volume and concentration of every pollutant released as a result of the event;
(c) the name, address and telephone number of every employee or agent of the licensee who witnessed the event;
(d) the name, address and telephone number of every other person (of whom the licensee is aware) who witnessed the event, unless the licensee has been unable to obtain that information after making reasonable effort;
(e) details of any remedial action taken by the licensee or any other person in relation to the event;
(f) details of any measure taken or proposed to be taken to prevent or mitigate against a recurrence of such an event.

S8.4 The EPA may make a written request for further details in relation to any of the above matters if it is not satisfied with the report provided by the licensee. The licensee must provide such further details to the EPA within the time specified in the request.

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Licence Number: 005161

In Force Until: 30 June, 1998

Certificate of compliance

S9.1 The licensee must supply the following particulars to the EPA, and must provide a certificate to the EPA, certifying that those particulars are correct:

Monitoring conditions

(a) whether all monitoring required by this licence has been carried out;

(b) if all the monitoring has not been carried out, what monitoring has not been carried out and the reasons why the monitoring has not been carried out;

(c) whether all the monitoring data required to be reported to the EPA by this licence has been reported to the EPA;

(d) whether all that monitoring data was reported within the time specified by this licence;

(e) if all the monitoring data has not been reported to the EPA, or has not been reported within the time specified, the reasons why the monitoring data has not been so reported;

(f) whether all the monitoring data reported to the EPA was derived from monitoring carried out in accordance with this licence;

(g) if any of the monitoring data reported to the EPA was not derived from monitoring carried out in accordance with this licence, what monitoring data was not so derived and the reasons why the monitoring data was not so derived;

Compliance with conditions

(h) whether every condition of this licence has been complied with;

(i) if one or more conditions have not been complied with, in relation to each such condition:

  (i) the nature of the non-compliance; and

  (ii) the reasons for that non-compliance; and

  (iii) any action taken to prevent, control or mitigate the non-compliance; and

  (iv) any action that has been or will be taken to prevent a recurrence of the non-compliance.

S9.2 The certificate must be in the form entitled "Pollution Control Act 1970 - Certificate of Compliance" available from any office of the EPA.

S9.3 The certificate must be provided to the EPA no later than 6 weeks after the date of expiry of this licence.

S9.4 If this licence is a renewed licence, the certificate required by any previous licence held by the licensee must be provided to the EPA no later than 6 weeks after the date of expiry of the previous licence.

S9.5 If the licensee is a natural person, the certificate must be signed by the licensee.

S9.6 If the licensee is a corporation, the certificate may, as an alternative to the affixing of the corporate seal, be signed:
(a) by the chief executive officer of the corporation; or
(b) by any other person approved by the EPA in writing.

NOTE: The certificate must not be completed or signed before the licence expires, as you must report your compliance with licence conditions for the entire licence period.

Licence must be kept at premises

S10.1 A copy of this licence must be kept at the premises.

S10.2 The licence must be produced to any officer of the EPA who asks to see it.

S10.3 The licence must be available for inspection by any employee or agent of the licensee working at the premises.

Responsible employees

S11.1 This condition does not apply if the licensee is a natural person who conducts the operation by himself or herself.

S11.2 The licensee must authorise at least two of the licensee's senior employees or agents:
(a) to speak on behalf of the licensee; and
(b) to provide any information or document required under this licence.

S11.3 The licensee must authorise those persons, and inform the EPA of the names and telephone numbers of those authorised persons, within 14 days of the date of this licence coming into force.

S11.4 If this licence is a renewed licence, and the licensee has previously authorised persons and informed the EPA of their names and addresses, the licensee is not required to again inform the EPA if those people continue to be authorised and their telephone numbers have not changed.

S11.5 The licensee must inform the EPA of any change in the information

done 4/12/97.

Licence Number: 005161 In Force Until: 30 June, 1998

provided under this condition within 14 days of the change.

S11.6 Any person authorised by the licensee must be readily contactable on the person's nominated telephone number during regular working hours.

POLLUTION REDUCTION PROGRAMME

The following undertakings or works must be completed by the specified completion dates where those dates fall within the currency of this licence. Where the specified completion dates are beyond the currency of this licence, all investigations, works and other activities as necessary must be carried out during the currency of this licence to ensure that specified future dates will be complied with.

P1. NOISE REDUCTION PROGRAM

1. ENVIRONMENTAL OUTCOMES

The Licensee must take all practicable measures to ensure that on or before 31 October 1997 the following conditions are met:

(a) the sound pressure level LA10 J (T=15 minutes) of noise emanating from the Premises does not exceed LA10 40 dB(A) during Daytime and does not exceed LA10 35 dB(A) during Nighttime when measured at any point within 20 metres of a residential dwelling located outside of the Premises;

(b) all noise emissions from the Premises are substantially free of tonal characteristics during Daytime and Nighttime; and

(c) all noise emissions from the Premises are substantially free of impulsive characteristics during Daytime and Nighttime.

Definitions:

In this condition:

"Daytime" means:

(a) From Monday to Saturday - 7.00 am to 10.00 pm; and

(b) On Sundays and public holidays - 8.00 am to

10.00 pm

"Nighttime" means:

(a) From Monday to Saturday - 10.00 pm to 7.00 am

(b) On Sundays and Public Holidays 10.00 pm to 8.00 am.

In this Licence

"Environmental Outcomes" means the matters specified in paragraphs (a),(b) and (c) of this condition.

2. MONITORING AND REPORTING

(a) From the date of this Notice, during each quarter of the licensing period (commencing, 1 July, and 1 September as applicable), the Licensee must carry out the following noise monitoring:

i) noise monitoring such as is required to calculate daytime and nighttime LA10T and LA90T at points:

(A) suitable for measuring noise emanating from the Premises; and

(B) in close proximity to each residential dwelling at the Monitoring Points.

ii) under suitable weather conditions two nights of attended monitoring conducted within a two week period each consisting of a minimum of three fifteen minute periods at the Monitoring Points BG4, BG5A, BG12A and a reference site, that is, a site representative of the noise contributed by the mine and which is relatively free of extraneous noise from non-mining activities.

iii) an unattended continuous 72 hour monitoring survey at Monitoring Points BG2, BG3, BG4, BG5A, BG8 and BG12A and a reference site, that is, a site representative of the noise contributed by the mine and which is relatively free of extraneous noise from non-mining activities.

iv) in addition to the monitoring required by condition 2(a)iii) monitoring at site BG12A and the reference site must be conducted such that continuous concurrently activated tape recorded monitoring is also conducted to record sound for a minimum of 10 minutes in every hour during which the 72 hour survey is conducted.

Definition:

In this condition:

BG2, BG3, BG4, BG5A, BG8 and GB12A are the monitoring sites refered to in Report number 5083-R9 entitled " Noise Compliance Monitoring - September 1996 Stratford Coal Project - Stratford NSW prepared by Richard Heggie Associates Pty Ltd for Stratford Coal Pty Ltd" and dated 3 December 1996.

(b) The Licensee must prepare a Noise Monitoring Assessment Report ("NMAR") and submit the NMAR to the EPA within 6 weeks of the end of the quarter during which the noise monitoring (as applicable) is required to be undertaken by this Licence.

The NMAR must:

i) be prepared by a suitably qualified expert;

ii) contain the results of the noise monitoring carried out as required by subparagraph (a) of this condition;

iii) include an assessment of the contribution of noise emanating from the Premises to the noise measured at the Monitoring Points (as applicable);

iv) ~~in~~ addition to the presentation of data required by subparagraph (ii) of this condition, present the data for Monitoring Point BG12A:

(A) graphically in the same format as Appendix K of document entitled "Report 5083-R9, Noise Compliance Monitoring- September 1996 Stratford Coal Project - Stratford NSW (3 December 1996)" hereafter referred to as Report 5083-R9;

(B) graphically in the same format as Appendix K of Report 5083-R9 but including only that monitoring data which represents LA10, LA90, wind speed and direction and excluding any data collected during periods when:

(I) wind speed at the Monitoring Point BG12A or as measured at the mine site is greater than 5 metres per second; or

(II) rainfall at Monitoring Point BG12A or as measured at the mine site is greater than 0.2 mm/15 minutes; and

v) present daytime and nighttime wind roses for wind speed and direction of the seasonal averages of wind data collected at the weather station located at the mine site on the Premises.

B. NOISE CONTROL WORKS

(a) In this condition, the Acoustic Barriers referred to, must be constructed to specifications that are at least such as to meet the following requirements:

i) be at least as high above the level of the road as is the clearance height of the highest vehicle that will be used at any time along that road;

ii) be continuous in length along the haul roads except to the extent that:

(A) the acoustic barrier would be required to cross over a road intersection; or

(B) it is not reasonably practicable to continue the barrier across a watercourse.

iii) Where because of the reason specified in subparagraph (a)(ii) an Acoustic Barrier is required to have a gap in it, such alternate acoustic barriers as are approved in writing by the EPA must be erected to fill those gaps.

(c) By 31 September 1997, the Licensee must submit to the EPA a Report (the "Main Coal Haul Road Acoustic Barrier Report") that assesses the effectiveness of the Main Haul Coal Road Acoustic Barrier to achieve noise level emission reductions from the Premises to the north of the Main Haul Coal Road and more specifically the achievement of the Environmental Outcomes specified in condition 1.

(d) Except to the extent that such barriers have already been constructed, the licensee must:

(i) cause acoustic barriers to be constructed along the

entire existing length of the:

(A) Western Haul Road, being the road which heads north along the western side of the pit;

(B) Eastern Haul Road, being the road which heads north along the eastern side of the pit; and

(ii) continue to construct such Acoustic Barriers along such roads within a reasonably practicable time as and when those roads are extended.

4. NOISE INVESTIGATIONS

(a) On or before 12 December 1997, the Licensee must:

i) complete the field testing of noise control treatments for Haul Truck mobile plant used at the Premises referred at dot point 5 at pages 23 and 24 of the Noise Management Plan (the "Trials");

ii) forward a Report (the "Mobile Plant Noise Control Work Trials Report") to the EPA in relation to the Trials so conducted.

The Mobile Plant Noise Control Works Trials Report must:

A) identify the options as a result of the Trials for achieving reduction of noise emissions from Haul Truck mobile plant operating at the Premises;

B) the likely cost of implementation of each option identified; and

C) the amount of the noise reduction associated with each option identified.

SPECIAL CONDITIONS

P2. COMPLAINT RESPONSE PROCEDURES

The Licensee must operate, maintain and publicise a telephone service which is available to receive reports or inquiries of pollution incidents 24 hours per day. This telephone number must provide for immediate relay of the complaint to an appropriate company officer.

When a report of a pollution incident is received, the Licensee or its representative must :-

a) immediately investigate the incident and implement such measures as are practicable to address the matter

b) advise the caller in a reasonable time and at a reasonable hour, the probable cause of the incident and the actions to be taken by the licensee to address the complaint received.

The Licensee must nominate at least two persons (and their telephone numbers) who will be available to the EPA on a 24 hours basis, and who have authority to take immediate action to shut down any activity, or to effect any pollution control measure, as directed by an authorised officer of the EPA.

P3. LAND CLEARING

P3.1 Areas cleared of vegetation in preparation for overburden removal and coal extraction must be kept to the minimum necessary for mining purposes.

P3.2 Areas to be cleared of vegetation must have adequate cleanwater diverion structures in place prior to the commencement of clearing.

P3.3 All runoff from cleared areas must be collected and directed to an adequately sized sedimemtation dam.

P4. Surface water from all untontaminated areas must be diverted away from disturbed, contaminated and mining areas, coal handling and storage sites, wastewater treatment and storage facilities and effluent disposal areas.

P5. All runoff from coal stockpiles and other contaminated areas must be directed to sedimentation ponds or other wastewater facilities for appropriate treatment.

P6. Sediment collected in sedimentation ponds must be removed whenever the volume of the basin is reduced by 30%, or on any other occasion as required by the EPA, such as where sediments are contaminated, or where a build-up of sediments may occur around the outlet structure.

P7. Overpressure caused by blasting must not exceed 115 dB (linear peak) for more than 5% of the total number of blasts over a period of 12 months when measured at any private residence not located on property owned by the Licensee. The level must not exceed 120 dB (linear peak) at any time.

P8. Ground vibration caused by blasting must not exceed a peak

particle velocity of 5 mm/second for more than 5% of the total number of blasts over a period of 12 months when measured at any residence not owned by the Licensee. The level must not exceed 10 mm/second at any time.

P9. MONITORING REQUIREMENTS

The following monitoring must be undertaken during the licence period.

AIR QUALITY

Equipment for the monitoring and reporting of ambient dust levels (dust deposition) must be located at the locations and operated at the intervals referred to in the report entitled " Stratford Coal Annual Environmental Monitoring Plan Report (March 1996).

WATER QUALITY

Surface water quality at the locations referred to in the report entitled " Stratford Coal Annual Environmental Monitoring Report (March 1996) must be monitored monthly for the following parameters :

. pH
. electrical conductivity in uS/cm
. total suspended solids
. turbidity
. filterable iron.

In the event that rainfall on the premises exceeds 25 millimetres in any 24 hour period the Licensee must as soon as is practicable after the rainfall event is recorded:

i) monitor the water quality at each of the locations and for each of the parameters referred to above; and
ii) in not less than 12 hours and not more that 24 hours repeat the monitoring referred to in (i) above.

Groundwater quality at the locations referred to in the report " Stratford Coal Annual Environmental Monitoring Report, (March 1996) must be monitored at intervals of not less than 5 months and not more than 6 months for the following parameters:

. pH
. Electrical Conductivity in uS/cm
. Chloride

. Sulphate
. filterable iron.

BLASTING

Ground vibration and air blast overpressure must be monitored on each occasion blasting occurs on the premises at the locations referred to in the document " Stratford Coal Annual Environmental Monitoring Report (March, 1996). The monitoring conducted by a suitably qualified person and in accordance with s.3.3 of the document entitled " Technical Basis for Guidelines to Minimise Annoyance Due to Blasting Overpressure and Ground Vibration (ANZECC, 1990). The results reported as:

. Peak Particle Velocity (ppv) in millimetres per second
. Air Blast overpressure in dB (linear peak).

METEOROLOGICAL DATA

The licensee must maintain and operate equipment on the premises for the purpose of monitoring the following:

. daily rainfall in millimetres
. daily maximum and minimum air temperature.
. wind velocity, direction and Sigma theta according to Australian Standard 2923 "Ambient Air - Guide for the Measurement of Horizontal Wind and Air Quality Application".

SOLID WASTE DISPOSAL

The licensee must maintain a chronological record of all solid waste(s), as defined by the Waste Minimisation and Management Act, buried in the mining void or the overburden emplacement(s) as agreed by the EPA. The record must include a description of the waste, estimate of the quantity and the burial location.

P10. ANNUAL REPORT

The licensee must prepare an annual report. The report must be in a format agreed to in writing by the EPA and must contain:

P10.1 a) A plan(s) identifying the areas mined or prepared for mining during the licence period and the location of major items of fixed plant and equipment.

b) A plan(s) showing the position of all noise

control barriers constructed prior to and during the licence period relative to the haul roads, major plant and equipment and property boundaries. Barriers constructed during the licence period must be clearly identifiable from the barriers constructed prior to this licensing period.

c) A plan(s) showing the location of all drainage or water management structures and any modifications made to these structures during the licence period.

d) A plan(s) showing the location of all monitoring points at which monitoring is required to be conducted as a condition of this licence. Each monitoring location must be assigned a specific identification number of code.

P10.2 All monitoring data required to be collected by this licence including an evaluation of the data against the conditions of this licence, statutory limits or guidelines included in the following publications:

i) Clean Air Regulations
ii) Clean Waters Regulations
iii) Australian Water Quality Guidelines for Fresh and Marine Waters (ANZECC, 1992)
iv) National Guidelines for Control of Emission Air Pollutants from New Stationary Sources (AENCNHMRC, 1985)
v) Technical Basis for Guidelines to Minimise Annoyance Due to Blasting Overpressure and Ground Vibration, (ANZECC, 1990)
vi) Environmental Noise Control Manual (EPA, 94/31)

P10.3 An assessment of the factors contributing to any exceedence of the conditions of this licence, statutory limits or guidelines referred to in condition P10.2 and an assessment of the environmental impact attributable to the exceedence(s).

P10.4 A chronological record of all incidence resulting in the overtopping of a pollution control dam or structure. The record must contain the date or dates during which overtopping occurred, the quality of the water leaving the structure, a description of the circumstances leading to the event and the action taken to prevent a recurrence

of the incident.

P10.5 A table showing the number of complaints received, the reason for the complaint and the action taken by the Licensee.

P10.6 Within 6 weeks of the date of expiry of this licence the Licensee must forward a copy of the annual report to the EPA's office at 117 Bull Street Newcastle West 2302. The report must be addressed to the Regional Manager- Hunter.

Further conditions with respect to the Clean Air Act 1961

Licence Number: 005161 In Force Until: 30 June, 1998

Prescribed Use Classification: COAL INDUSTRY WORKS, CLASS I

Operational Scale: more than 500 kilotonnes per annum

1. Coal stockpiles and coal handling areas must be maintained, at all times, in a condition which minimises wind-blown or traffic-generated dust.

2. Blasting must not be undertaken if the prevailing wind speed and/or direction is likely to cause a noticeable increase in the level of dust deposited on residential premises.

3. Guide posts or other suitable barriers must be used to define trafficable areas, to identify areas to be watered and to prevent traffic movement on to unsealed or untreated sections of the premises.

A4. Unsealed haul roads, manoeuvring and other traffic areas must be maintained, at all times, in a condition which minimises the emission of wind-blown or traffic-generated dust.

5. All spillage(s) of material arising from any operation on the premises which is likely to be a source of wind-blown or other dust emissions, must be cleaned up or treated as required to prevent such emissions.

6. Overburden must not be dumped in areas which are not sheltered from the prevailing wind when the wind speed exceeds 10 meters per second averaged over a 5 minute period.

EPA NOTICE DATED 18.9.97

EPA

Environment
Protection
Authority
New South Wales

NSW Government Offices
117 Bull Street Newcastle West NSW 2302
PO Box 488G Newcastle NSW 2300
Tel .049. 26 9971 Fax .049. 29 6712

The Manager
Stratford Coal Pty Ltd
PO Box 168
GLOUCESTER NSW 2422
Attention: Doug Gordon

Our Reference:
272234A5 ST:ST

Your Reference:

18 SEP 1997

Contact: Shane Trengove

Dear Sir

POLLUTION CONTROL LICENCE STRATFORD MINE

I refer to you letter of 8 September 1997 and your facsimile of 25 August 1997 concerning the Environment Protection Authority's (EPA) draft notice amending Pollution Control Licence number 5161.

The attached Notice under Clause 17D(3) of the Pollution Control Act incorporates the amendments negotiated between the EPA and Stratford Coal.

I also confirm that your property at 27 Avon Street, Stratford is acceptable to the EPA for the purpose of blast monitoring in accordance with condition P9.3 of you licence.

If you have any further enquiries regarding this matter please contact Mr Shane Trengove on (02) 49269966.

Yours sincerely

Grahame Clarke
Head Regional Operations Unit - Hunter
for Director-General

enc.

CERTIFIED MAIL

STRATFORD COAL PTY LTD
P.O. BOX 168
GLOUCESTER NSW 2422

Environment
Protection
Authority
New South Wales

NSW Government Offices
117 Bull Street Newcastle West NSW 2302
PO Box 488G Newcastle NSW 2300
Tel .049. 26 9971 Fax 049. 29 6712

Our Reference: 272234/A05/Not. Nos. 004521

Your Reference:

17 September, 1997

NOTICE UNDER SECTION 17D(3)
OF THE POLLUTION CONTROL ACT 1970

WHEREAS -

(a) STRATFORD COAL PTY LTD is the holder of licence number 005161 in respect of premises situated at MINING LEASE 1360 OFF WOOD STREET, STRATFORD which expires on 30 June, 1998.

TAKE NOTICE THAT -

In accordance with the powers vested in the Environment Protection Authority (EPA) under Section 17D(3) of the Pollution Control Act 1970, the EPA with respect to licence number 005161 from the date of this Notice hereby:-

Revokes the following condition(s)

1 P1.2(a), P3(c), P9, P10.2, P10.4 and P10.5, and

Attaches the following condition(s):

2 P1.2 MONITORING AND REPORTING

(a) During each quarter of the licensing period (commencing, 1 July, and 1 September as applicable), the Licensee must carry out the following noise monitoring:

i) noise monitoring such as is required to calculate daytime and nighttime LA10T and LA90T at points:

(A) suitable for measuring noise emanating from the Premises; and

(B) in close proximity to each residential dwelling

at the Monitoring Points.

ii) under suitable weather conditions two nights of attended monitoring conducted within a two week period each consisting of a minimum of three fifteen minute periods at the Monitoring Points BG4, BG5A, BG12A and a reference site, that is, a site representative of the noise contributed by the mine and which is relatively free of extraneous noise from non-mining activities.

iii) an unattended continuous 72 hour monitoring survey at Monitoring Points BG2, BG3, BG4, BG5A, BG8 and BG12A and a reference site, that is, a site representative of the noise contributed by the mine and which is relatively free of extraneous noise from non-mining activities.

iv) in addition to the monitoring required by condition 2(a)iii) monitoring at site BG12A and the reference site must be conducted such that continuous concurrently activated tape recorded monitoring is also conducted to record sound for a minimum of 10 minutes in every hour during which the 72 hour survey is conducted.

Definition:

In this condition:

BG2, BG3, BG4, BG5A, BG8 and BG12A are the monitoring sites refered to in Report number 5083-R9 entitled " Noise Compliance Monitoring - September 1996 Stratford Coal Project - Stratford NSW prepared by Richard Heggie Associates Pty Ltd for Stratford Coal Pty Ltd" and dated 3 December 1996.

P3. NOISE CONTROL WORKS

(c) By 30 September 1997, the Licensee must submit to the EPA a Report (the "Main Coal Haul Road Acoustic Barrier Report") that assesses the effectiveness of the Main Haul Coal Road Acoustic Barrier to achieve noise level emission reductions from the Premises to the north of the Main Haul Coal Road and more specifically the achievement of the Environmental Outcomes specified in condition 1.

P9. MONITORING REQUIREMENTS

The following monitoring must be undertaken during the licence period.

P9.1 AIR QUALITY

Equipment for the monitoring and reporting of ambient dust levels must be located at the locations and operated at the intervals referred to in the report entitled "Stratford Coal Annual Environmental Monitoring Plan Report (March 1997).

Monthly dust deposition must be measured at sites D5, D6, D7, D8, D9 and D10 in accordance with Australian Standard 2724.1-1984. Six day 24 hour Total Suspended Particulates (PM10) at sites HVD1 and HVD2 by high volume air samplers operated in accordance with Australian Standards 2724.3 and 3580.9.6 respectively.

P9.2 WATER QUALITY

a) Surface water quality at the following locations identified in the report entitled "Stratford Coal Annual Environmental Monitoring Report (March 1997) - W1, W2, W3, W4, W5 and W6 must be monitored monthly for the following parameters :

- pH
- electrical conductivity in uS/cm
- total suspended solids
- turbidity
- filterable iron.

In the event that rainfall on the premises exceeds 25 millimetres in any 24 hour period the Licensee must as soon as is practicable after the rainfall event is recorded :

i) monitor the water quality at each of the locations specified above and for each of the parameters referred to above; and

ii) in not less than 12 hours and not more that 24 hours repeat the monitoring referred to in (i) above.

b) Groundwater quality at locations referred to in the report "Stratford Coal Annual Environmental Monitoring Report, (March 1997) must be monitored once in April and once in October for the following parameters:

- pH
- Electrical Conductivity in uS/cm

P9.3 BLASTING

Ground vibration and air blast overpressure must be monitored on each occasion blasting occurs at sites BG3 and BG8 identified in the report "Stratford Coal Annual Environmental Monitoring Report, (March 1997) and one site in Stratford village approved in writing by the EPA.

The monitoring is to be conducted by a suitably qualified person and in accordance with s.3.3 of the document entitled "Technical Basis for Guidelines to Minimise Annoyance Due to Blasting Overpressure and Ground Vibration (ANZECC, 1990). The results reported as:

- Peak Particle Velocity (ppv) in millimetres per second
- Air Blast overpressure in dB (linear peak).

P9.4 METEOROLOGICAL DATA

The licensee must maintain and operate equipment on the premises for the purpose of monitoring the following:

- daily rainfall in millimetres
- daily maximum and minimum air temperature.
- wind velocity and direction according to Australian Standard 2923 "Ambient Air - Guide for the Measurement of Horizontal Wind and Air Quality Application".

P9.5 SOLID WASTE DISPOSAL

The licensee must maintain a chronological record of all solid waste(s), as defined by the Waste Minimisation and Management Act, buried in the mining void or the overburden emplacement(s) as agreed by the EPA. The record must include a description of the waste, estimate of the quantity and the burial location.

P10. ANNUAL REPORT

P10.2 All monitoring data required to be collected by this licence including an evaluation of the data against the conditions of this licence, statutory limits or guidelines included in the following publications:

i) Clean Air Regulations
ii) Clean Waters Regulations
iii) Australian Water Quality Guidelines for Fresh and Marine Waters (ANZECC, 1992)
iv) National Guidelines for Control of Emission Air Pollutants from New Stationary Sources (AENCNHMRC, 1985)
v) Technical Basis for Guidelines to Minimise Annoyance Due to Blasting Overpressure and Ground Vibration, (ANZECC, 1990)
vi) Environmental Noise Control Manual (EPA, 94/31)
vii) Quarterly Air Quality Monitoring Reports (NSW EPA).

P10.4

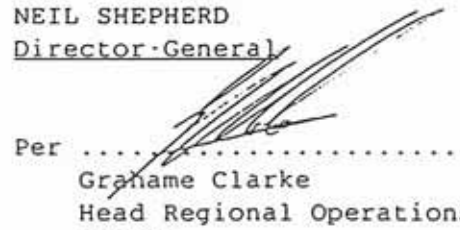
A chronological record of all events when the overtopping of a pollution control dam or structure occurred. The record must contain the date or dates during which overtopping occurred, the quality of the water leaving the structure, a description of the circumstances leading to the event and the action taken to prevent a recurrence of the incident.

P10.5

A computer record on diskette in a format satisfactory to the EPA showing the number of complaints received, the reason for the

complaint and the action taken by the Licensee.

NEIL SHEPHERD
Director-General



Per .....
Grahame Clarke
Head Regional Operations
HUNTER
(by Delegation)

Use Of Meteorological Conditions When Assessing Operational Noise

The EPA recommends that the assessment of operational noise impacts be conducted with consideration of the existing meteorological conditions that would be expected to occur at a particular site for a significant period of time. These meteorological conditions may include calm, wind and temperature inversions. The effects of all phenomena should be addressed to determine the full noise impact.

The [redacted] suggests that the noise calculations conducted for neutral weather conditions are the appropriate noise levels for comparison with the EPA planning levels.

The EPA does not support the use of the term "neutral" weather conditions because it does not address noise enhancing weather conditions and it may under estimate the impacts of noise. The guidelines in the EPA's Environmental Noise Control Manual (ENCM) do not refer to "neutral" meteorological conditions. The NSW Minerals Council has in a recent letter to the EPA supported the view that impacts should be assessed for the conditions that pertain at a site and not be limited to "neutral" conditions.

With regard to setting statutory conditions such as in development consents, the term "prevailing" would be recommended in conjunction with any performance based noise limit that is applied to the project. Prevailing weather conditions include calm and windy conditions but excludes temperature inversions.

Since the issue of temperature inversions is complex both in determining when they occur and how they influence noise impacts it is EPA's policy that the extent of their impact to managed in the license by using a noise monitoring and complaints based approach. Where complaints are significant the company would be required to develop management strategies. These strategies would be described in the company's noise management plan by identifying the sources; identifying and implementing engineering and operational methods of noise control; and monitoring the effectiveness of those measures with the affected community.

If you require any further information or clarification, please do not hesitate to contact me.

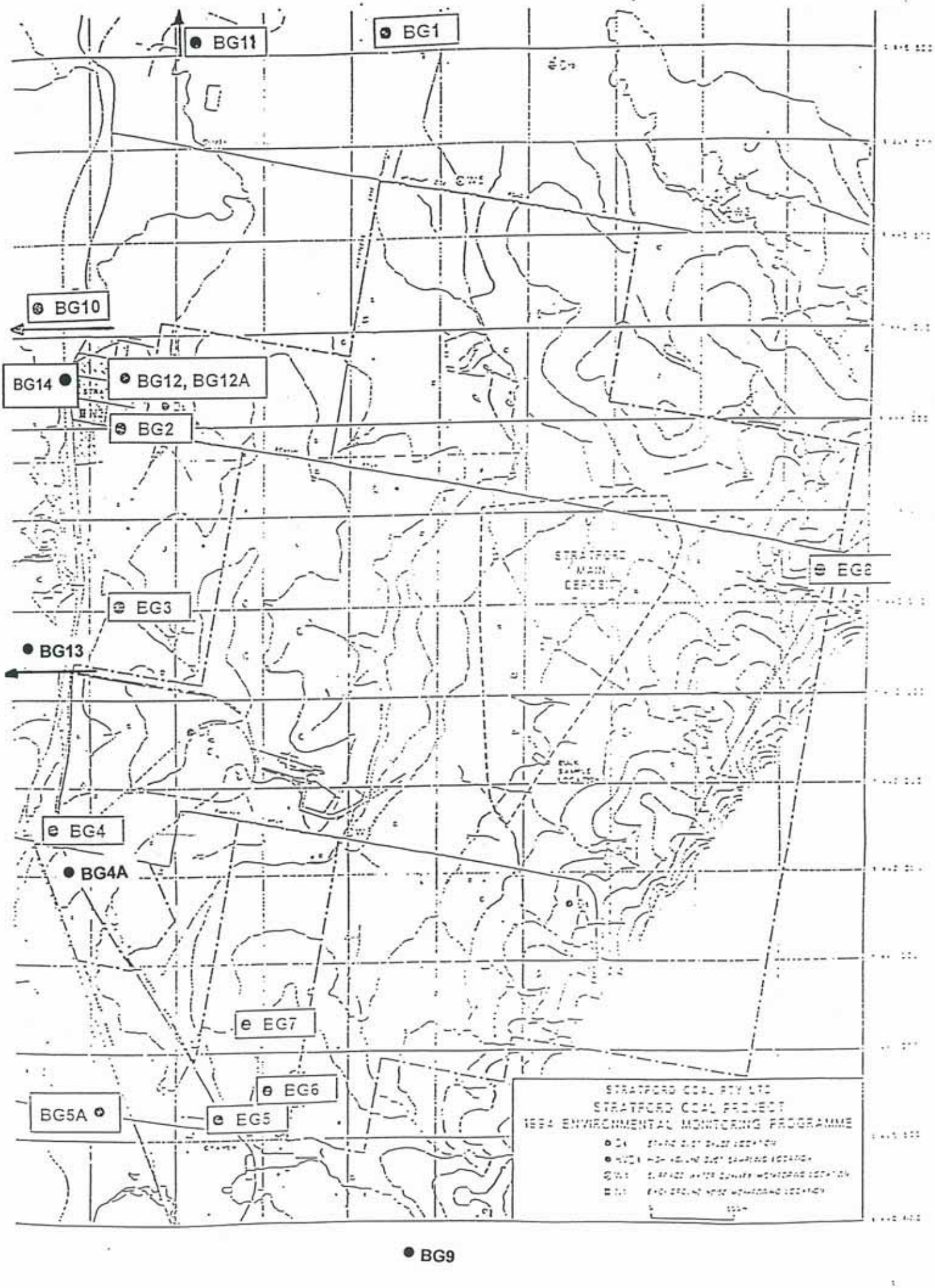
Yours sincerely

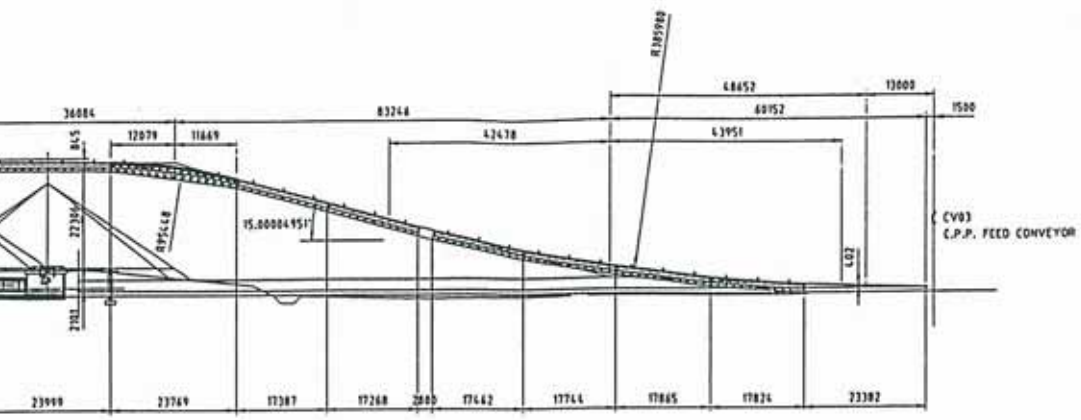
[redacted]

Encl

Figure 5.2.1 Background Noise monitoring Locations

LOCATION PLAN





Appendix E

Report 8140-R1

PRODUCT CONVEYOR DIAGRAMS

Coffey Geotechnics Pty Ltd

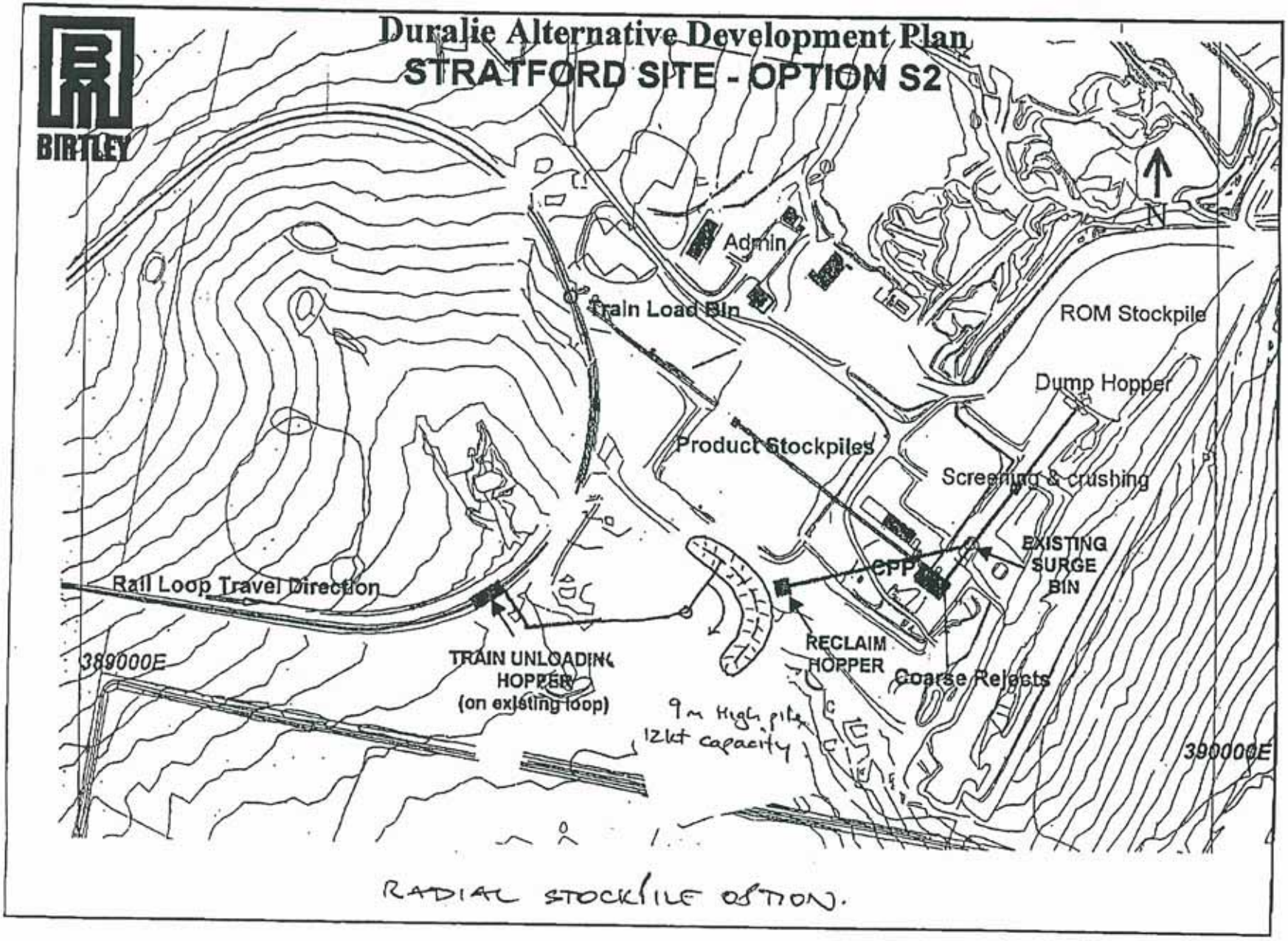
CLIENT: STRATFORD COAL PTY LTD

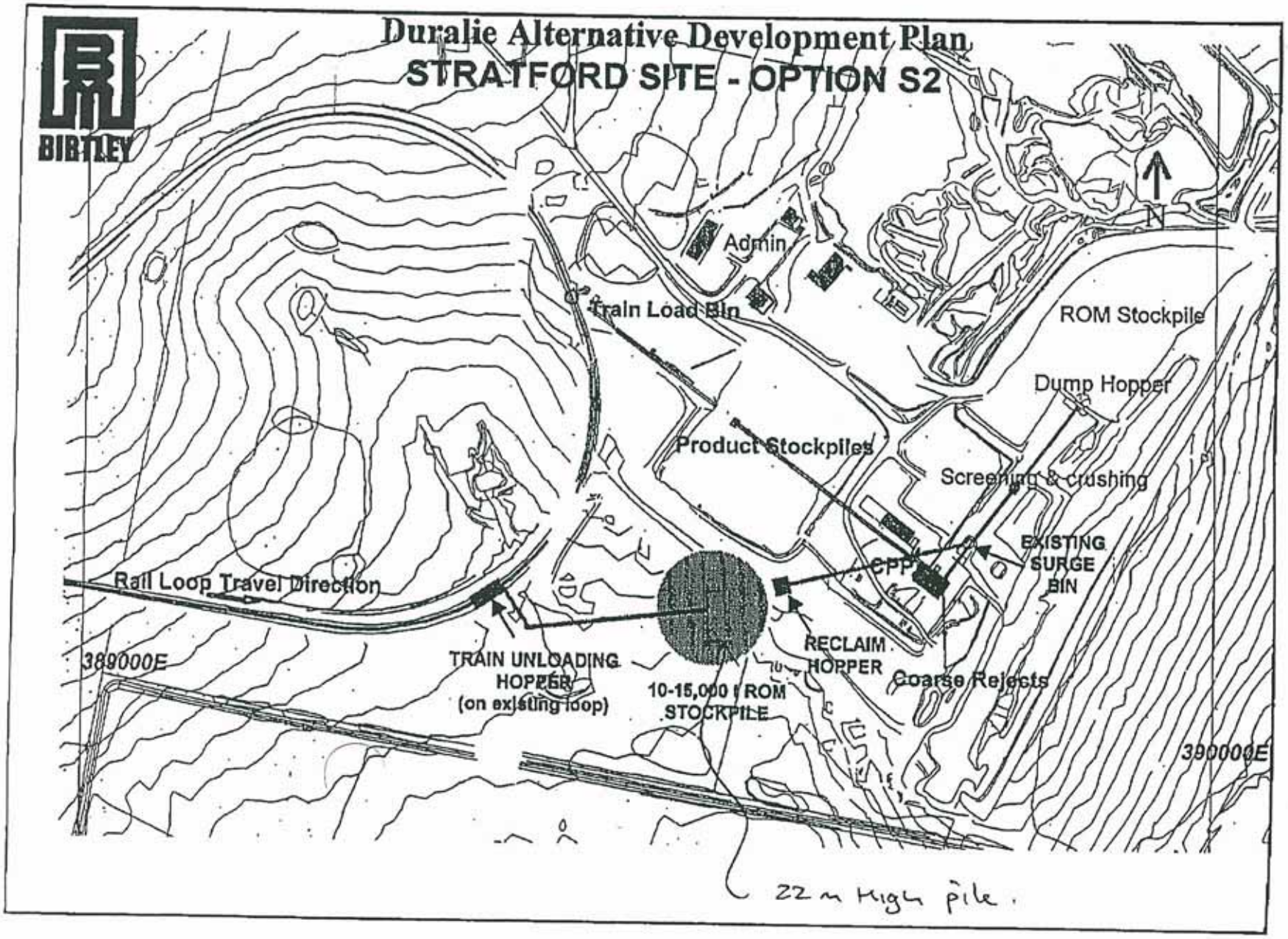
STRATFORD COAL PROJECT

GENERAL ARRANGEMENT
CONVEYOR ELEVATIONS - PRODUCT

C02-1-4-006

CAD FILENAME: C02*4C06


Duralie Alternative Development Plan
STRATFORD SITE - OPTION S2
BIRTLEY
N
Admin
Train Load Bin
ROM Stockpile
Dump Hopper
Product Stockpiles
Screening & crushing
EXISTING SURGE BIN
CPP
Rail Loop Travel Direction
389000E
TRAIN UNLOADING HOPPER (on existing loop)
RECLAIM HOPPER
Coarse Rejects
9m High pile 12kt capacity
390000E
RADIAL STOCKPILE OPTION.


Duralie Alternative Development Plan
STRATFORD SITE - OPTION S2
BIBTLEY
N
Admin
Train Load Bin
ROM Stockpile
Dump Hopper
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Screening & Crushing
EXISTING SURGE BIN
CPP
Rail Loop Travel Direction
389000E
TRAIN UNLOADING HOPPER (on existing loop)
10-15,000 t ROM STOCKPILE
RECLAIM HOPPER
Coarse Rejects
390000E
22 m High pile.