Prepared For:
Bloomfield Collieries Pty Limited

ENVIRONMENTAL IMPACT STATEMENT FOR PROPOSED MODIFICATION OF MINING OPERATIONS - RIXS CREEK COAL MINE

Prepared by

ENVIROSCIENCES PTY LIMITED

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November 1994

FORM 2

SUBMISSION OF
ENVIRONMENTAL IMPACT STATEMENT (EIS)
prepared under the Environmental Planning and Assessment Act 1979
Section 77

EIS prepared by

name: ENVIROSCIENCES PTY LIMITED
qualifications: LEANNE HARRIS, BSc
address: 122 Parry Street, Newcastle West, NSW, 2302

in respect of

development application

applicant name: BLOOMFIELD COLLIERIES PTY LIMITED 76880106972
applicant address: Rixs Creek Lane, via Singleton NSW 2330

land to be developed: address, lot no, DPMPS, vol/fol etc: See attached details

proposed development: **extension/modification of open cut mining operations at Rixs Creek Coal Mine**

environmental impact statement

☑ an environmental impact statement (EIS) is attached

certificate

I certify that I have prepared the contents of this Statement and to the best of my knowledge

- it is in accordance with clauses 51 and 52 of the Environmental Planning and Assessment Regulation 1994, and
- it is true in all material particulars and does not, by its presentation or omission of information, materially mislead.

Signature: Leanne Harris

Name: LEANNE HARRIS
ENVIROSCIENCES PTY LIMITED

date: 29/11/94

DESCRIPTION OF LANDS WITHIN COAL LEASE 352 AT RIX'S CREEK SINGLETON

(A) Lands that embrace the surface and land below thereof to an unlimited depth.

Lots 8, 9, 10, 11, 12 & 13 in Deposited Plan 251001
Lots 5, 6, 7, 8, 9, 10, 11, 13, 14, 15, 16, 17, 18 and part of Lots 19 & 21 of Deposited Plan 739911.

Lot 2 Deposited Plan 110564
Part of Lot 5 Deposited Plan 264089
Part of Lot 10 Deposited Plan 251618
Lots 23 & 89 Deposited Plan 752442

The aforementioned Lots fall in the area of the lease to the North of the New England Highway and to the West of Middle Falbrook Road to a Northern limit of Latitude 32° 30' 00" S in the Parish of Auckland, County on Durham.

Lot 5 Deposited Plan 739912 (excepting thereout the lands within a radius of 200 metres of the house located on the subject lot and situated adjacent to the junction of the Middle Falbrook Road and the New England Highway, together with those lands within a 50 m radius of a dam located on the aforementioned Lot 5 and being adjacent to the New England Highway).

Lot 9 & part of Lot 8 Deposited Plan 739912, Part Portion 83, Deposited Plan 752442 (being that part of Portion 83 that is west of the Main Northern Railway line). Lot 23 & 89 Deposited Plan 752442.

The aforementioned Lots fall in the area of the lease to the north of the New England Highway, to a Northern limit of Latitude 32° 30' 00" S in the Parish of Auckland, County of Durham.

Lots 1, 2, 3 & 4 Deposited Plan 581908, Lots 3 & 4 Deposited Plan 573333, Lot 1 Deposited Plan 449426, Part Portion 139 Deposited Plan 419341, Part Portion 137 Deposited Plan 752455. Part of Portion 82,97 & 84 to the West of Longitude 151° 09' 00", Lot 1 & 2 Deposited Plan 598097, Part Portion 4 Deposited Plan 752455, Lots 10, 11, 12 & 13 Deposited Plan 739913.

The aforementioned Lots fall in the area of the lease to the north of the New England Highway to a Northern limit of Latitude 32° 30' 00" S in the Parish of Darlington, County of Durham.

Lot 8 & 13 and part of Lots 7, 9 & 14 Deposited Plan 739913, part of Lot 102 Deposited Plan 740380.

The aforementioned Lots fall in the area of the lease to the South of the New England Highway in the Parish of Darlington in the County of Durham.

Lots 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166 & 167 Deposited Plan 752442, Lot 15 Deposited Plan 251617, Part Portion 57 & 58 Deposited Plan 252692.

The aforementioned Lots fall in the area of the lease to the South of the New England Highway and to the East of Rix's Creek in the Parish of Auckland County of Durham.

Lots 146, 147, 148, 149, 150, 151, 152, 153, 154 Deposited Plan 752442, part of Lot 1 Deposited Plan 804005.

The aforementioned Lots are in the lease area to the South of the New England Highway and to the West of Rix's Creek in the Parish of Auckland County of Durham.

Unalienated Crown lands that are located adjoining and to the South of the New England Highway and being East of Part Portion 57 and Portion 58 Deposited Plan 252692 in the Parish of Darlington. Together with the unnamed roads within the village of Auckland in Deposited Plan 752442. Middle Falbrook Road to the North of the 200 m radius from the house located in Lot 5 Deposited Plan 739912 at the intersection of Middle Falbrook Road and the New England Highway in the Parish of Auckland.

(B) Lands that have surface exception of 20 metres and an unlimited depth restriction.

Lot 4 Deposited Plan 251618, part of Part Portion 85 to a Northern limit of Latitude 32° 30' 00" S, part of Lot A Deposited Plan 404824, Lot 20 and part of Lot 12 Deposited Plan 739911, part of Lot 55 Deposited Plan 252692, Lot 6, 10 & 11 Deposited Plan 739912, Part of Lot 1 Deposited Plan 126663, Lot 1 Deposited Plan 413053, part of Lot 1 & 2 Deposited Plan 804005 to a Southern limit of Latitude 32° 32' 40" S, Part of Lots 1004 & 1005 Deposited Plan 811415 to a Southern limit of Latitude 32° 32' 40" S.

Together with the unalienated Crown Lands to the East of Lot 2, Deposited Plan 804005 and Rix's Creek to a Southern limit of Latitude 32° 32' 40" S. The aforementioned lots are all within the lease area and are south of the New England Highway and are West of Rix's Creek in the Parish of Auckland County of Durham and have a Western limit of the ISG Grid value of 310000 East.

Part of Lot 172 Deposited Plan 727694, part of Lots 1004 & 1005 Deposited Plan 81145.

Together with the unalienated Crown Land to the East of Lot 172 Deposited Plan 727694. The aforementioned lots are all within the area of the lease and are South of the New England Highway and East of Rix's Creek to a Southern limit of Latitude 32° 32' 40" in the Parish of Auckland County of Durham.

Part of Lot 102 Deposited Plan 740380, part of Lot 1 & 2 Deposited Plan 622634.

The aforementioned Lots are within the lease area and are to the South of the New England Highway and to the East of Rix's Creek in the Parish of Darlington County of Durham to a Southern limit of Latitude 32° 32' 40".

Lot 7 & 10 Deposited Plan 251618, part of Lot 5 Deposited Plan 739912, part of Lots 11 & 21 Deposited Plan 739911 and part of Middle Falbrook Road, being that part of the lot and road that is within a radius of 200 metres of a dwelling located on the subject lot and adjacent to the junction of Middle Falbrook Road and the New England Highway together with those lands within a 50 metre radius of a dam located on the subject lot and being adjacent to the New England Highway.

The aforementioned Lots are within the lease area and are to the North of the New England Highway and to the West of Rix's Creek in the Parish of Auckland in the County of Durham.

The New England Highway South from Latitude 32° 30' 00" to the intersection of the Highway and Rix's Creek Lane in the Parishes of Auckland and Darlington, County of Durham.

All the above lands on this and the previous page are within Coal Lease 352 in the Parishes of Auckland and Darlington, County of Durham, Shire of Singleton.

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SECTION 1

INTRODUCTION

1.1 THE PROPOSAL

Bloomfield Collieries Pty Limited are proposing to expand their current open cut mining operation at Rixs Creek near Singleton (refer to **Figure 1**). This expansion in coal mining activities will encompass an increase in both the volume of production and the areal extent of the mine.

Development consent for the Rixs Creek Coal Mine was initially granted by the Minister for Planning on 19 October, 1989 and Coal Lease 352 was issued on 20 October, 1989. The mine continues to operate in 1994 in accordance with the Development Consent and the Lease. Consent conditions and lease requirements place restrictions on the recovery of the coal resources within the Coal Lease and on the efficiency of the operations.

Coal Lease 352 occupies an area of approximately 1,818 ha of land, of which 786 ha is prohibited from open cut mining by a surface exception to a depth of 20 m (refer to **Figure 2**). Following a directive from the Minister of Mineral Resources (refer **Appendix 1**) Rixs Creek have applied for a lease that will remove this surface exception. The intention of the present application is to obtain consent to mine by open cut methods, and without surface exception, in the whole of the area encompassed by Coal Lease 352 within the limits as specified in the proposed mining plan.

The present open cut is restricted to a production rate of 1.5 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal. The Company is seeking an approval that will allow it to produce 2.5 Mtpa of ROM coal amounting to an average saleable production rate of 1.5 Mtpa. In order to achieve this production rate a conceptual mining plan has been developed for the site that involves a maximum total movement of mined materials of 15 million bank cubic metres per year, including overburden, interburden and coal. The conceptual mining plan has been used for the estimation of mining impacts on the environment and to demonstrate that the coal resource can be efficiently recovered by the mining methods proposed.

The mine plan is not definitive in the sense that the application is based on a particular mining method and mining schedule. The conceptual mine plan is based on a set of parameters that ensure that the environmental impacts assessed using the plan as a basis are the maximum realistic impacts that should be considered. Mining will be confined to the boundaries as defined by the conceptual mine plan (**Figure 3**).

The conceptual mining plan is the subject of this environmental impact statement (EIS). The plan has been designed to provide the Company with a greater flexibility. To this end the Company also proposes to install additional equipment and to have restrictions on operating times currently in place removed (refer to **Appendix 3**.)

Mining is currently carried out on the site using scrapers, loaders and trucks. The raw coal is washed in the site's coal preparation plant. Coarse reject is trucked to overburden dumps and buried and fine reject is transported by pipeline to a tailings dam. Product coal is trucked to the Rixs Creek - Camberwell Joint Venture rail loop for transport to Newcastle. All coal produced on the site is sold to export markets.

The mine infrastructure including the coal preparation plant, rail loading facilities, offices and workshops have been established in accordance with the development consent conditions of 1989 and provide sufficient facilities for the maximum capacity of the proposed operation (refer **Appendix 3**). There are no proposed changes to the raw coal handling and preparation facilities on the site. The washing plant has sufficient capacity to cater for the proposed expansion. When the mine reaches maximum production an overland conveyor may be installed to transport product coal from the washery to the rail loop eliminating internal road transport of product coal. If the total capacity of the site's coal preparation plant and coal handling facilities are not absorbed, the Company may seek to wash and load other Company's coal on the Rixs Creek site, subject to all relevant approvals.

Experience gained since the Rixs Creek coal mine commenced has demonstrated that the predictions of dust and noise emissions made prior to operation of the mine were

conservative. Environmental monitoring at the mine has been continuous and intensive since before operations commenced on the site. This has provided detailed measurements that have illustrated that for noise and dust in particular, the modelled "area of affectation" defined for the mine is larger than is required to meet the criteria adopted (refer to **Appendix 5**). Similarly, Camberwell Open Cut, located immediately north of Rixs Creek, has accumulated similar monitoring experience that reflect much lower impacts than those predicted by modelling.

For this study therefore, actual monitoring results from both the Rixs Creek and Camberwell operations have been superimposed on predictive models for the proposed expansion in order to gain a more realistic interpretation of potential noise and dust impacts. The Camberwell operation is considered suitable for this purpose given its proximity to Rixs Creek which enables a meaningful comparison of weather, topography and types of materials being moved. Additionally the current Camberwell operation is equivalent to the proposed Rixs Creek expansion in terms of areal extent, production rate and types of equipment utilised.

Rixs Creek are, therefore, proposing that any condition of development consent requiring the Company to purchase affected land be based on the affectation determined by monitoring of the mining operation being in excess of the limits used to set the current "area of affectation". It is proposed that the predicted area of affectation as defined in the 1989 development consent no longer apply. The existing rights, however, under the 1989 consent of the nominated land owners will still apply (refer to **Appendix 10**).

In summary the main components of the proposed expansion at Rixs Creek include:

- the mining capacity being increased to 15 million bank cubic metres of material per year resulting in a production rate of approximately 1.5 Mtpa of saleable coal;
- removal of restrictions of operating times to allow mining 24 hours per day, 7 days per week, up to 365 days per year;
- additional equipment levels including a dragline;

- increases in manning levels on-site of approximately 46 to 50 personnel; and
- removal of surface restrictions in the whole of the area encompassed by Coal Lease 352 and consent to mine in the area as defined by the conceptual mine plan.

1.2 PROFILE OF BLOOMFIELD COLLIERIES

Rixs Creek Colliery is owned by Bloomfield Collieries Pty Limited, a 100 per cent Australian owned private company with extensive links in the Hunter Valley. Bloomfield Collieries Pty Limited was incorporated in 1952. In addition to the Rixs Creek Mine, the Company currently operates an open cut coal mine at East Maitland.

The present owners took over the Bloomfield Colliery mining leases at East Maitland in 1937. The Bloomfield Colliery Holding, of some 1,300 ha, is situated 1.5 km south of East Maitland and linked by rail to the Newcastle coal loader. Coal is produced by open cut methods from the seams of the Tomago Coal Measures. Unmined reserves of recoverable saleable coal are estimated to be approximately 26 million tonnes.

Bloomfield Colliery is one of the oldest suppliers of coal to the Japanese steel mills, having made its first shipment in May 1958.

Bloomfield Collieries Pty Limited has remained in the forefront of developments in coal mining, processing and marketing in New South Wales since its inception. The Company's founder was amongst the first miners to use electrical power and mechanical loaders underground, originally at Dudley Colliery near Newcastle. A coal preparation plant was first established on the East Maitland site in 1954 and since that time the Company has built up considerable experience in the field of coal beneficiation. The Company introduced the first D10 bulldozer in New South Wales, the first 23 m^3 electric face shovel in the Australian coal industry and the first 46 m^3 shovel into any extractive industry in this country.

Bloomfield Collieries Pty Limited is a participating shareholder in Port Waratah Coal Services Limited. An associated company, Hunter Valley Earthmoving Pty Limited provides contract mining services for open cut operations at a number of mines in New South Wales.

1.3 BACKGROUND

An environmental impact statement (EIS) was prepared and submitted together with Coal Lease Application No. 185 for the Rixs Creek Open Cut Mine near Singleton. The development consent for coal mining operations to proceed at Rixs Creek was issued on 19 October 1989. This approval followed a long and protracted process that commenced in the mid 1970s and culminated in a Commission of Inquiry that was conducted in April 1989.

Following the granting of development consent, construction on the site commenced in November 1989. Construction of the access road, haul road and a hard stand area and installation of a weigh bridge and truck wash down bay proceeded through the initial six months of 1990 in conjunction with the sealing of Rixs Creek Lane. These elements of infrastructure were located on a truck access point adjacent to the intersection of Rixs Creek Lane and the New England Highway.

Consent to carry out open cut mining operations was granted on 2 April 1990 by the Department of Mineral Resources. This consent was granted for a five year period which corresponded to Stage 1 of the mining proposal as set out in the EIS. Coal production commenced on 23 July 1990 in an area adjacent to the New England Highway. This area had been previously mined by underground methods and the surface had been disturbed by gravel quarrying.

The original development consent was to produce 0.3 Mtpa of raw coal for the first 5 years with raw coal being trucked for 2 years and then transported by rail for a further 3 years to the Bloomfield coal preparation plant at East Maitland. In Year 6 of the project the raw

coal output was to increase to 1.5 Mtpa and a coal preparation plant was to be commissioned on the site. Coal washability and handlability showed, however, that the raw coal mined at the site was not suitable for rail transport. This led to the commissioning of a coal preparation plant on the Rixs Creek site at an earlier date. To facilitate the transportation of coal by rail a coal load out bin, clean coal stockpiles and associated gantry and conveyor system were constructed. Originally this infrastructure was proposed to be located within property owned by Bloomfield as outlined in the original EIS. Subsequent to this a joint rail loop facility, in accordance with Condition 27 of the original development consent, between Rixs Creek and Camberwell mine was decided upon. As a result a statement of environmental effects was prepared for the stockpile and rail loading facility and development consent was granted on 18 October 1990. This facility became operational in April 1993 and all of the mine production is transported by rail to the Newcastle coal loader.

Appendix 3 details the current development consent conditions under which the mine now operates. It describes those conditions that have been satisfied as well as those that are no longer applicable.

1.4 NEIGHBOURING COAL MINES AND EXPLORATION AREAS

Coal mines and exploration areas (Authorisations) in the vicinity of Rixs Creek are shown in **Figure 4**.

The nearest coal mine to the lease is Camberwell Open Cut, owned and operated by the Camberwell Joint Venture. This operation occupies former Authorisations 81 and 308 and is located immediately north of Rixs Creek.

Maitland Main Collieries Pty Limited are proposing to establish an underground mining operation to the north of Camberwell, at Glennies Creek at some time in the future.

The Department of Planning are currently compiling a cumulative impact report for mining developments within the Hunter Region. Cumulative impacts anticipated from this development are discussed in **Appendices 5** and **6**.

1.5 APPROVALS HELD AND TO BE OBTAINED

Rixs Creek Mine expansion will be controlled by planning, mining and environmental legislation of New South Wales. This section details the regulations and legislation that control the existing mine and highlights approvals that will need to be obtained to implement the proposed changes to the existing operation.

1.5.1 Licences and Approvals Held

Rixs Creek operates under the control of the following approvals and licences:

Development Consent

Development consent for the existing mine was granted on 19 October 1989. This consent allows the mine to operate in the existing manner subject to a number of development consent conditions (refer to **Appendix 3**). The Company received approval to slightly amend three of its original development consent conditions on 29 July 1993.

The Company also holds separate development consents for the construction and use of its rail loop and loading facilities issued on 18 October 1990 and for the bridge over the New England Highway on 7 January 1994.

Mining Titles

Rixs Creek operates within Coal Lease No. 352, issued on 20 October 1989 which is valid for a period of 21 years from the date of issue.

Mining Approvals

The area currently covered by open cut approvals from the DMR is shown on **Figure 12.** These cover both the current mining areas to the north and south of the New England Highway. Two open cut approvals have been issued to the mine, the first on 11 February 1992 and the second on 12 August 1994.

EPA Licences and Approvals

The mine holds an EPA licence (No. 3391) issued on 3 April 1994. This authorises the mine to operate under the conditions of the Pollution Control Act 1970 as a scheduled premises.

The EPA have also issued consents to construct works for:

i. train loading facilities - 29 December 1992

ii. coal preparation plant - 15 November 1992.

DWR Licences

Rixs Creek also operates under various licences issued by the DWR including:

Licence No. 48955	-	issued 5 December 1990
Licence No. 205L49786	-	issued 21 October 1992
Licence No. 205L50160	-	issued 20 January 1993.

Compensation Agreement

The mine has a specific compensation agreement - the Bowman Compensation Agreement. This was registered on 14 January 1992.

1.5.2 Licences and Approvals to be Obtained

In order to proceed with the proposed extension of operations Rixs Creek will be required to obtain the following approvals and licences.

Development Consent

A new development consent is being sought to replace the existing consents and to authorise the extensions of mining as described in this document.

Mining Titles

A new mining lease is required that will remove surface exceptions currently in place. The extent of the lease application area is shown in **Figure 12a**.

Mining Approvals

Before commencement of mining in the new mining pits, Rixs Creek will need to obtain the relevant open cut approvals. These will need to be obtained on a regular basis from the Department of Mineral Resources.

EPA Licences and Approvals

For the extended operations it will be necessary to obtain:

- approvals to construct works under the Clean Air Act, Noise Control Act, and
- amended licences under these Acts.

1.6 JUSTIFICATION FOR THE DEVELOPMENT

The proposal to extend the operations of Rixs Creek Coal Mine beyond the confines imposed in the development consent of 19 October 1989 has arisen out of the experience of the Company in operating the mine. Originally it was planned to mine, by open cut methods, those areas of the lease that had been subject to previous underground mining. In the first year of the mine's operation this was attempted, however, it has proved impractical. In the major seams which were previously mined by underground methods so much of the coal was removed that mining the remainder by open cut methods was uneconomic. Accordingly those plans were abandoned. New mining plans were formulated to mine other areas within the development consent and these are approved, as occasionally amended, by the Department of Mineral Resources as part of an ongoing process.

The change in mine plan has meant that the life of the area in which mining is permitted in accordance with the development consent is now not sufficient for the 21 year term of the development consent and coal lease. The development consent imposed the condition that surface mining cannot take place outside the area included in the 21 year mine plan as shown in the original EIS. The coal lease, however, gives surface rights in a much more extensive area.

There has been progress made in the development of mining equipment and mining methods since the original EIS was formulated. To remain competitive in the industry, it is necessary for the company to continually upgrade its methods and equipment to current technology.

The geology of the coal strata within Coal Lease 352 is such that the resource can only be recovered efficiently by open cut mining methods. Of the 1,818 ha of land within the lease, 786 ha have been subject to a surface exception to a depth of 20 m which prohibits open cut operations. Consent has been obtained from the Minister of Mineral Resources to

apply for a lease that will remove this surface exception. The intention of the present application is therefore, to obtain consent to mine without surface exception, the whole of the area encompassed by Coal Lease 352 within the confines of the proposed mining plan.

The conditions of the development consent were based on the assessment of the impacts predicted for the operation of the mine. These impacts were based on the mine plan as shown in the EIS and the equipment and mining methods nominated. The company is now seeking to change the mine plan, the equipment and the mining methods in accordance with experience in operating the mine thus far, including new market conditions and changes in technology.

While it is recognised that development consent may only be granted for a limited period a conceptual mine plan has been prepared to mine the whole of the resources within Coal Lease 352 at the nominated maximum rate of material movement. The conceptual mine plan has a mining schedule to mine the whole of the measured resource over 40 years. Experience at Rixs Creek has already demonstrated that mine plans must change according to the physical, geological and economic circumstances. The conceptual mine plan extending through the whole of the resource has allowed impacts to be assessed on the basis of mining anywhere in the resource. The current application is, therefore, based on conducting mining operations within the limits of maximum annual movement of material anywhere within the resource at any time during the term of the Development Consent subject to the regular approval of mining plans by Department of Mineral Resources in accordance with the Coal Lease, the Coal Mining Act and the Coal Mines Regulation Act.

1.7 LIAISON WITH GOVERNMENT AND COMMUNITY ORGANISATIONS

1.7.1 Government Consultations

The proposed amendments to the Rixs Creek Coal Mine Development Consent were formally introduced to New South Wales and local government authorities at a Planning

Focus meeting held on 17 November 1993 at Singleton Council Chambers. Representatives of the following authorities were present:

Department of Planning (DOP)
Singleton Council
Department of Mineral Resources (DMR)
Environment Protection Authority (EPA)
Department of Conservation and Land Management (CALM)
Roads and Traffic Authority of NSW (RTA)

At this meeting a document outlining the proposal was issued to each authority and a presentation was made by Rixs Creek personnel. Attendees were given the opportunity to ask questions and tour the project site. They subsequently provided written comments to the DOP.

The National Parks and Wildlife Service and the Department of Water Resources were advised of the project by means of a letter. All comments raised by authorities both in writing and during discussions have been taken into account during the preparation of this EIS. The requirements of the Director, Department of Planning are presented in **Appendix 2.**

Members of Singleton Council were informed of the project and invited to tour the project site on 11 April 1994. During the tour the attendees were shown the current operations and proposed expansion areas at Rixs Creek. A tour was also made around the Camberwell open cut site to enable comparisons to be made between the sites.

When assessing the draft EIS for this project, the Department of Mineral Resources noted a number of potential impacts, which in their opinion, would result in some adverse effect on certain aspects of the surrounding environment. As a result, the Department requested that the proponent prepare an alternative mine plan for the area, in order to reduce these perceived impacts. This alternative mine plan, as outlined in Section 6.4 of this document, is the preferred option of the Department of Mineral Resources for the mining of this area.

1.7.2 Community Consultations

Ongoing community consultation has been maintained on both a formal and informal basis since the commencement of operations at Rixs Creek. As a condition of development consent a Rixs Creek Environment Monitoring Committee was established and has met twice annually since construction began on the site. A total of nine such meetings have taken place. Based on the meetings so far and the performance of the mine, the DMR have decided that the meetings should now be held annually.

The committee has been convened by the DMR and has been chaired by Mr R. Hughson of that Department. It is comprised of representatives from Singleton Council, the EPA, the local community and Rixs Creek personnel. Monitoring results are provided at this meeting, together with an update of current mining methods and information relating to any official complaints that have been received. To date only one complaint has been received related to overpressure from blasting. This situation was resolved and the problem rectified.

Additional community consultation was undertaken when Rixs Creek made a presentation outlining the proposed expansion to a public meeting of Singleton Council on 2 May 1994. Notification of the Rixs Creek presentation was advertised in local newspapers. Following the presentation both Councillors and members of the public were given the opportunity to ask questions about the development.

1.8 FORMAT OF THE IMPACT STATEMENT

The environmental impact statement for the proposed amendments to the Rixs Creek Coal Mine Development Consent is presented in one volume. The text has been written in six sections, as outlined below, with a set of appendices. The document covers the requirements of the Environmental Planning and Assessment Act and Regulations.

Section 1 : Introduction - outlines the scope of the proposal. Describes the corporate interests of Bloomfield Collieries and discusses the background and justification for the proposal. Neighbouring coal mines and exploration areas are given and consultation with government agencies are discussed.

Section 2 : Existing Environment - describes the physical, biological and cultural background of the Rixs Creek area.

Section 3 : Existing Mining Operations - describes the current open cut mining operations at Rixs Creek as well as the coal handling, preparation and transportation of product coal. Current water management, rehabilitation status and environmental monitoring programmes are discussed.

Section 4 : Proposed Expansion of Mining Operations - describes the geology and coal resources of the Rixs Creek Mine and the nature of the proposed expansion of the open cut. Proposed water management, rehabilitation and extensions to existing environmental management plans are presented.

Section 5 : Impact of the Proposal on the Environment - predicts the potential impacts of the proposed expansion of the open cut mine on the environment and presents measures to be implemented to mitigate the impacts.

Section 6 : Alternatives to the Development - discusses alternatives to the proposed development and gives the consequences of not proceeding with the project.

1.9 STUDY TEAM

This report has been prepared by Envirosciences Pty Limited.

The following sub-consultants also contributed to the study:

Nigel Holmes and Associates - air quality assessment
Caleb Smith Consulting Pty Limited - noise assessment

The following staff provided information related to the project on behalf of Bloomfield Collieries:

Reg Crick	Mine Superintendent
Brian Watson	Environmental Officer
Chris Moy	Surveyor

Garry Bailey	Mine Manager
Felicity Thomson	Mining Engineer
Peter Murray	P J Murray & Associates

and Engineering Computer Services regarding mine planning.

SECTION 2

EXISTING ENVIRONMENT

2.1 REGIONAL SETTING

Rixs Creek Coal Lease is located in the upper Hunter Valley of New South Wales (refer **Figure 1**) approximately 1.5 km northwest of Singleton. A prominent ridgeline and the Main Northern Railway separate the lease from the western limits of Singleton Heights. The New England Highway runs through the lease in a northwesterly to southeasterly direction.

Rixs Creek flows through the lease in a southwesterly direction to its confluence with the Hunter River approximately 5 km from the site.

The rich and accessible coal resources in the Singleton area have resulted in the development of several mines in the area. In addition to Rixs Creek, Camberwell Pty Limited operate an open cut mine immediately to the north while Lemington is the closest mine to the west (refer to **Figure 4**).

2.2 TOPOGRAPHY AND SLOPES

The topography of the lease area is illustrated in **Figure 5**.

The landform within the lease is undulating with steeper grades on the upper and middle slopes and flatter areas adjacent to Rixs Creek. The relief ranges from a maximum height of approximately 170 m AHD in the northwest to approximately 60 m AHD where Rixs Creek intersects the southern boundary of the site.

The major topographical features of the lease are the valley of Rixs Creek which drains most of the site southwest towards the Hunter River and a prominent hill, Obanvale Relay Tower to the northeast. Other obvious ridges and hills to the east separate the mining area from the residential areas of Singleton Heights and to the southeast from residences along Maison Dieu Road.

The majority of the area has slopes which are less than 2 degrees with much of the remaining area having gradients of between 2 and 5 degrees. Areas with grades of between 5 and 10 degrees are confined to upper slopes while areas greater than 10 degrees occur along the banks of deeply eroded stream lines.

2.3 SOILS

2.3.1 Introduction

Soil types within the study area have previously been identified and mapped by Croft and Associates (1989). Further soil investigations have also been undertaken by Wayne Perry and Associates to fulfil requirements of the open cut applications for the site. Both soil survey reports are included as **Appendix 7**.

Soils on the site were investigated by observing excavated pits and profiles were classified using the Northcote Factual Key (Northcote, 1989). Various horizons were sampled for physical and chemical testing and analysis. Field and laboratory data were used to assess the thickness and suitability of soils on the site for conservation and use as a topdressing material in rehabilitation after mining.

2.3.2 Description of Soil Types

The main soil types occurring within the study area include:

Yellow Duplex Soils
Red Duplex Soils
Uniform Soils

The distribution of these soil types is shown in **Figure 6**.

The Duplex soils display minor variations due to topography, slope and drainage. As a general rule, the Red and Yellow Duplex soils are found in toposequence. The Yellow

soils occur in areas of poor drainage on lower slopes and drainage lines and the Red soils on the higher slopes and ridge tops. Uniform soils, characterised by small to negligible textural differences, are evident as isolated zones of ridge gravel.

Yellow Duplex soils predominate along Rixs Creek and adjoining middle to lower slopes in the central part of CL352. These soils may contain some organic matter in their horizons in the form of weathered coal products. They are characterised by sharp textural changes down the profile resulting in poor water infiltration and drainage making these soils highly susceptible to erosion.

Red Duplex soils are commonly associated with the better drained upper slopes and ridge tops. These soils are generally more stable once disturbed.

The Uniform coarse soils occupy only small areas of CL352. These medium to coarse gravels which occur at two locations form the bulk of the soil material throughout the profile. These are located on prominent ridgetops and have little agricultural value and have no worth for rehabilitation works. A quarry operating in one of these areas, adjacent to Middle Falbrook Road, supplies road base for internal roadworks.

2.3.3 Soil Stripping Depths

Laboratory results were used in conjunction with the field assessment to determine the depth or thickness of soil material which is suitable for stripping as shown in **Figure 7**. The location of all soil sampling sites from the Croft & Associates (1989) study is included in **Figure 6**.

The consistency of soil units and stripping depths was confirmed by Envirosciences via observation checks of soil exposures and augering. Observation sites are illustrated in **Figure 6**.

Results of laboratory analyses (**Appendix 8**) indicate that most samples have relatively undesirable textural properties. Throughout the site shallow A horizons tend to have a high sand content. B horizon soils have a high tendency to disperse and are unstable when the A horizon is removed. The soils are slightly acidic and exhibit an increase in pH with depth. Nutrient levels in the soils are low with the exception of iron. The concentration of salts and trace metals are also low.

Soil depth suitable for stripping and subsequent use as post mining topdressing material ranges from 10 to 20 cm over the area to be disturbed. Some 938,000 m^3 of topdressing will be available for use during rehabilitation operations.

2.4 LAND CAPABILITY

The Soil Conservation Service (Department of Conservation and Land Management) rural land capability system consists of eight classes which classify land on the basis of an increasing soil erosion hazard and a decreasing versatility of use. It recognises three types of land uses:

- land suitable for cultivation;
- land suitable for grazing; and
- land not suitable for rural production.

These capability classifications identify the limitations to the use of the land as a result of the interaction between the physical resources and specific land use. The principal limitation recognised by these capability classifications is the stability of the soil mantle (Soil Conservation Service, 1986).

Figure 8 shows the land capability of the lease area, mapped at a scale of 1:25,000. This plan (Croft and Associates 1989) has been extrapolated from the combination of broader scale maps prepared by the Soil Conservation Service (Cessnock 1:100,000) and field studies.

The majority of the lease area is comprised of class IV, V and VI land. These lands are generally suitable for grazing with classes V and VI comprising the less productive grazing lands.

Class IV and V lands are not suited for cultivation on a regular basis because of the limitations of slope, shallowness, rockiness or erosion potential of soils. Class VI lands are not suitable for cultivation at any time.

These less productive classes of land generally require some degree of structural soil conservation works to minimise land degradation.

A small area of class II land occurs along the Rixs Creek floodplain at the southern boundary of the lease area. This class of land is suitable for a wide variety of agricultural uses with a high potential for production of crops. However, class II land represents only approximately 2 per cent of the total lease area.

2.5 CLIMATE

2.5.1 Meteorological Data Source

A meteorological station has been established on the mine lease and has operated from 1990. Temperature (maximum and minimum), rainfall and wind speed and direction are recorded daily. The mean monthly values for the period 1990 to 1993 are presented in **Table 2.1** and **Figure 9** illustrates seasonal wind roses for this period.

2.5.2 Rainfall

The mean monthly rainfall and mean number of raindays given in Table 2.1 indicate that the highest rainfall occurs in the summer months with February representing the wettest month. Over the rest of the year rainfall is spread reasonably evenly with minimum values

being recorded in both May (33.5 mm) and October (33.7 mm). The Rixs Creek area on average receives an annual rainfall of 646.5 mm on 94 days of the year.

2.5.3 Temperature

Mean monthly values of daily maximum and minimum temperature are listed in **Table 2.1**. Summers are characterised by extremely hot conditions with temperatures in excess of 40^{0}C being recorded on occasions. In contrast minimum temperatures during the winter months often tend to be very low, with several records below 0^{0}C.

TABLE 2.1
METEOROLOGICAL DATA, RIXS CREEK
1990 to 1993

Month	Temperature		Rainfall (mm)	Number of Raindays
	Maximum	Minimum		
January	37.4	10.5	62.1	9
February	34.7	9	135.6	7
March	31.6	8.1	41.9	9
April	27.1	4.3	38.9	8
May	24.0	2.3	33.5	6.5
June	19.2	0.1	48.8	7
July	20.8	-1.2	47.7	8
August	22.1	-0.1	35.5	9
September	26.7	1.3	45.8	5.5
October	30.7	3.3	33.7	7
November	33.2	5.0	38.1	7.5
December	35.3	6.3	84.9	10
Annual Average	28.6	4.1	646.5	94

Source: Rixs Creek Pty Limited

2.5.4 Wind Speed and Direction

Wind data are collected at Rixs Creek using an anemometer and wind vane mounted at 10 m above ground level. Four years of on-site data have been collected to date.

Figure 9 illustrates seasonal and annual windroses for 1993. The windrose for Autumn (**Figure 9**) is based upon data for March only. Data for April and May are missing. Data for June and August are also missing therefore caution should be adopted when interpreting the wind roses for autumn and winter. **Appendix 5** contains site windroses for the remaining data collection period.

Examination of the windroses in **Figure 9** shows that over the year the most common winds were from the east-southeast, south-southeast and north-northwest. The southeasterlies are most common in summer and autumn. Northwesterlies predominate in winter months. Winds in spring are most frequently from the west-northwest, southeast or south-southeast.

2.6 FLORA AND FAUNA

A flora and fauna survey was undertaken throughout the Rixs Creek lease area by Envirosciences. This report is presented in **Appendix 4**.

The survey was undertaken to conform with National Parks and Wildlife Service (NPWS) requirements and included an assessment of remnant vegetation and rare plants as well as fauna identification and an assessment of the fauna significance on the site.

The flora and fauna study indicated that the lease area does not contain any significant habitat areas. The site has been extensively disturbed as a result of previous land uses and similar species and habitats exist in surrounding areas.

No rare or endangered plant or animal species were observed during the study or are considered likely to occur on the site.

2.7 HYDROLOGY

2.7.1 Surface Water Drainage

The project area is drained by the Rixs Creek catchment. This system joins the Hunter River approximately 5 km below the mining operations.

Rixs Creek generally flows from northeast to southwest along the entire lease. A small portion of the eastern side of the lease, adjacent to Rixs Creek Lane is drained by a minor tributary of Rixs Creek known as Stone Quarry Gully.

Drainage lines in the lease are ephemeral and cease to flow during prolonged dry periods. The lower reaches of Rixs Creek generally contain water which may extend continuously along the creek bed or be confined to isolated water holes. Permanent water in the lease is contained in a number of dams. The dams consist of those constructed for water management of the mining operation including dams for mine water and dams for clean runoff.

Runoff generated within the major catchments of the lease drains west, south and southwest towards the Hunter River. A narrow area, approximately 1.8 km^2 adjacent to the lease's northwestern boundary, drains towards Glennies Creek and then into the Hunter River.

Severe stream bank erosion and gullying are evident along all drainage lines and sheet erosion is evident on the lower slopes.

The main catchment on the lease, the Rixs Creek catchment is affected by the current mining operations. The drainage on undisturbed parts of the catchment has been modified

by the construction of a series of diversion banks and dams to divert clean runoff around the mining operations (refer **Section 3.8**).

The current mining operation has necessitated the diversion of Rixs Creek to the north of the New England Highway. The diverted channel has been formed through re-shaped overburden with a channel slope of approximately 1 per cent. The channel base has been sealed with clay and will be topsoiled and grassed. The channel re-enters the existing body of Rixs Creek after passing through a sedimentation dam which also acts as a velocity dissipater and then flows over a grassed slope.

2.7.2 Surface Water Quality

During the period 1981 to 1988 a pre-mining water quality monitoring programme was undertaken at four sites in the vicinity of the Rixs Creek Lease. Water samples collected during this period were analysed monthly for a range of parameters including pH, conductivity, suspended solids, soluble salts, turbidity, chloride, sulphate, sodium, calcium and magnesium. The location of these sampling sites are shown in **Figure 10** and are briefly described as:

- Site 1 - Farm dam within the current lease area;
- Site 2 - Farm dam;
- Site 3 - Rixs Creek at New England Highway Bridge;
- Site 4 - Rixs Creek at Maison Dieu Road.

Following the commencement of mining operations in 1990 a total of six surface water quality sites have been monitored on a regular basis. The location of these monitoring sites are shown in **Figure 10**. Samples are collected twice per month in Rixs Creek at three locations:

- Site 1A - as the creek enters the site;
- Site 2A - at the mid point of the lease;
- Site 3A - after the creek has left the site.

In addition water storage dams are monitored on a monthly basis as follows:

- Site 4A - Dam 1
- Site 5A - Dam 2
- Site 6A - Dam 6

Each site is analysed for pH, electrical conductivity, total dissolved solids and total suspended solids. The results of both of these monitoring programmes are detailed in **Appendix 9.**

Appendix 9 contains a detailed interpretation of the monitoring results at the mine in conjunction with mining activities.

2.7.3 Groundwater

Australian Groundwater Consultants Pty Limited (1981) were commissioned to undertake hydrogeological investigations in the Rixs Creek Lease area in order to determine occurrence, distribution, yield and quantity of groundwater.

Four electrical resistivity traverses were carried out to identify potential water bearing areas and/or structural lineations which may have indicated preferred groundwater paths. Vertical electrical soundings were also carried out to provide supplementary information on the geological sequence in areas where the traverses indicated an anomaly.

The groundwater survey indicated that in undisturbed areas of the lease groundwater occurs mostly under confined conditions. The coal seams form the main aquifer with the interburden materials forming the confining layers. In the coal seams groundwater occurs mainly in secondary structures, which include joints, cleats, fractures and bedding plane partings.

Groundwater contour levels were defined in the survey (**Figure 11**) and suggest recharge of the coal seam aquifers is occurring in the coal outcrop area along the eastern side of the site. It was predicted that subsurface flows would diminish as the coal is extracted and mining advanced to the west.

The amount of inherent groundwater at Rixs Creek has been measured in both the current north and south working areas. In both areas groundwater flow is in the order of 1 to 2 L/s. The area to the south of the highway, however, also contains isolated underground workings flooded with groundwater. These are of unknown volume due to a lack of records of the old workings. The water in these "dams" has built up over a number of years and the quantity cannot be accurately estimated.

All groundwater sources so far encountered during mining operations have been adequately controlled by in-pit dewatering. Typical large water makes have involved pumping at a rate of 26 L/s for 2 to 3 days then intermittent pumping after the initial inrush has settled. Groundwater that accumulates in the mine is pumped to dams as part of the site's water management system (refer to **Section 3.8.3**).

Natural groundwater discharge occurs in the central part of the lease area where the surface topography intersects the potentiometric surface. Discharges to Rixs Creek probably contribute to high salinity of flows in the Creek.

Hydraulic tests indicated that the majority of groundwater flows occur in the upper section of the coal seams. Below this the permeability decreases with depth and groundwater circulation is reduced.

2.7.4 Groundwater Quality

Analysis of groundwater quality, collected at various locations within the Rixs Creek Lease are given in **Appendix 9.**

2.8 AIR QUALITY

2.8.1 Dust Monitoring Programmes

The area surrounding Rixs Creek Mine is subject to a variety of land uses. The region is presently used for coal mining and agriculture, both of which result in the emission of atmospheric particulates. Atmospheric dust is also caused by road and rail traffic as well as by the action of the wind.

Monitoring of air quality in the vicinity of Rixs Creek has been undertaken on a relatively long term basis. In 1981, 10 deposition gauges were installed. An additional 4 gauges were established in 1982 and a further 2 were established in 1985 bringing the total to 16 gauges. This number was increased to a total of 27 in February 1990 after commencement of mining operations. The gauges are monitored on a monthly basis for insoluble solids, comprising ash and combustible matter, and soluble solids. The locations of the gauges are shown in **Figure 10** and a brief description is given below:

1 adjacent to railway line on eastern lease boundary
2 adjacent to railway line on eastern lease boundary
3 near old railway cutting
4 near Middle Falbrook Road on northern lease boundary
5 Rixs Creek Lane on Eastern boundary
6 near New England Highway
7 paddock opposite Middle Falbrook Road intersection
8 off Maison Dieu Road
9 off Maison Dieu Road near Dights Crossing Intersection
10 off Maison Dieu Road
11 Wattle Ponds Road
12 oval near Singleton Civic Centre
13 Lawson Avenue, Singleton Heights
14 Mines Rescue Station, Singleton Heights
15 Gardner Circuit, Singleton Heights
16 46 D'Arbon Crescent, Singleton Heights
17 The Retreat
18 Bridgeman Road
19 Main Northern Railway
20 Bridgeman Road
21 Bridgeman Road
22 Bridgeman Road
23 adjacent to Main Northern Railway
24 off Middle Falbrook Road
25 off New England Highway
26 Granbalang, New England Highway
27 off Wattle Ponds Road, adjacent to Hunter River

Total suspended particulates are monitored over 24 hours every 6 days using three high volume air samplers at the following locations:

i. Singleton Heights, Mines Rescue Station;

ii. Rixs Creek Lane;

iii. Off Bridgeman Road, Lot 2 The Retreat.

2.8.2 Existing Air Quality

Average annual dust deposition rates and total particulate levels during the period 1990 to 1993 are given in **Appendix 9**. **Appendix 9** also provides a detailed interpretation of the monitoring results at the mine in conjunction with mining activities.

As indicated in **Appendix 9**, the dust fallout levels in the Rixs Creek area are generally low, between 1 and 2 g/m^2/month insoluble solids (long term average). Four gauges, namely 5, 12, 17 and 27 exhibit slightly higher dust fallout levels of between 2 and 2.5 g/m^2/month. Of these, gauge 5 is located reasonably close to the mining operations, however, the remainder of these gauges are spread throughout the surrounding district at a considerable distance from the mine (refer **Figure 10**). Gauges 12 and 27 are furthest away from the mining operations and obviously indicate a high localised influence from surrounding cultivated land.

The EPA have recently refined the criteria for annual average dust (insoluble solids) deposition in residential areas (refer **Appendix 5**). In the case of Rixs Creek where the surrounding residential area exhibits annual average dust deposition levels of between 2 and 3 g/m^2/month an increase of up to 2 g/m^2/month would be permitted before it was considered that a significant degradation of air quality had occurred.

Annual average TSP levels for the three monitoring sites range between 38 and 61 $\mu g/m^3$ (refer to **Appendix 9**). The EPA refer to the National Health and Medical Research Council (NH&MRC) 90 $\mu g/m^3$ annual average goal for total suspended particulate matter when assessing long term dust impacts. This level is recommended as the maximum permissible level that should be permitted in urban environments. Recorded levels have been well within this goal for all three monitoring points.

Dust deposition levels have also been measured at eight sites in the vicinity of Camberwell Open Cut, immediately to the north of Rixs Creek. The results of this monitoring, during the period 1989 to 1993 ranged between 0.8 and 1.9 g/m^2/month. Four high volume air samplers are also maintained around the Camberwell lease area. Average results from these ranged from 35.29 to 48.01 $\mu g/m^3$ during the period October 1991 to June 1993 (ACIRL 1993). A full evaluation of the monitoring at Camberwell is given in **Appendix 5**.

Levels of both deposited dust and particulate matter recorded in the vicinity of the Camberwell operation reflect the monitoring results at Rixs Creek.

2.9 BACKGROUND NOISE

In accordance with development consent conditions background noise levels are recorded at four locations surrounding the mine at regular intervals. The locations of the monitoring sites are briefly described below and illustrated in **Figure 10**.

Site 1: "The Retreat" off Bridgeman Road, (Lot 2 Lethbridge Road) located approximately 25 m from dwelling and 6 m from high volume air sampler.

Site 2: Maison Dieu Road (Lot A, Glen Lomon) located approximately 20 m from dwelling and 20 m from Maison Dieu Road.

Site 3: Singleton Heights, Bower Parade.

Site 4: Middle Falbrook Road (Lot 9) located adjacent to dwelling.

Each site is monitored with a Bruel and Kjaer 2225 sound level meter set on "fast" response and a unidata logger to sample and log noise levels readings every five seconds over a 72 hour monitoring period. Each site is monitored twice per year and data has been recorded since 1990. A summary of noise levels recorded at these sites is presented in **Appendix 9**.

Additional background noise levels have been recorded at seven sites in the vicinity of the mining operation as part of an acoustical assessment for the proposed development. This work undertaken by Caleb Smith Consulting is presented in full in **Appendix 6.**

2.10 LAND OWNERSHIP AND RESIDENCES

Land owned by the Company and land tenure status in the lease area is illustrated in **Figure 12**. The majority of the lease area is owned by Bloomfield Collieries.

Other land within the lease area is owned by Durian (Holdings) Pty Limited; Denman/Singleton Pastures Protection Board; Wyoming Holsteins Pty Limited; Keith Heuston Pty Limited; W.G. Bowman & GR. Elder; E.S. Bowman; Canravo Pty Limited; A.S. Bowman; and Singleton Shire Council.

Other land adjacent to the lease boundary is owned by R.J. Everleigh; E. Pitt and T.C. & T.A. Humble. The land owned by T.C. & T.A. Humble is subject to an acquisition agreement under the present development consent conditions.

Figure 12a illustrates the mining lease application area and indicates properties surrounding the lease area.

2.11 LANDUSE

Land use in and around the lease area is illustrated in **Figure 12b.**

RIXS CREEK LEASE AREA

Coal has been extracted from the lease area intermittently from the 1870s through until 1948. The mines were located along the strike of the coal seams on the eastern half of the lease. Coke produced by the burning of coal in the ovens on the site was subsequently utilised for copper smelting at Cobar (Croft & Associates, 1989).

The other predominant landuses within the lease area have included cattle and sheep grazing as well as quarries used as a source of road gravels.

The old mining activities, coupled with grazing have substantially degraded the land and disturbed the soils within some parts of the lease area.

SURROUNDING LANDUSES

Agricultural

Beef cattle grazing is undertaken on undulating land surrounding the lease. The other principal agricultural use in the area is cropping which is undertaken on alluvial soils adjoining the lower reaches of Rixs Creek, south of Maison Dieu Road.

Residential

Population growth in Singleton township has concentrated in Singleton Heights in recent years and is expected to continue in this area and adjoining undeveloped lands in the future. Singleton Heights Estate offers residential blocks while The Retreat, further along Bridgman Road offers rural residential blocks. The western edge of Singleton Heights lies approximately 2.5 km from the current mining area. The Retreat is situated 2 km east from the mine.

Larger properties occupy the undulating land and river flats to the west and southwest of the site respectively. Hobby farms and small rural/residential properties are concentrated along Maison Dieu Road and the southern reaches of Rixs Creek.

Industrial and Commercial Users

Existing and proposed coal mines in proximity to Rixs Creek are discussed in **Section 1.4**.

Other industrial developments in the surrounding area are concentrated in the Industrial Area subdivision on Maison Dieu Road. These light industries are engaged in transport, automative and engineering activities as well as servicing the mining industry. Several blocks are currently available in the subdivision and are awaiting development.

Other

A variety of other landuses occur in the vicinity of Rixs Creek. These include a caravan park, Department of Main Roads office, Council Depot and a motel.

2.12 TRANSPORT SYSTEMS

The existing road network in the Rixs Creek area is shown in **Figure 10**. The principle roads in the area include: the New England Highway running diagonally across the site and protected from mining by a 100 m buffer zone; Rixs Creek Lane which serves primarily as an access road into the mine site; and Middle Falbrook Road which passes through part of the proposed mining area. Details of the proposed relocation of Middle Falbrook Road are discussed in **Section 4.8** while the existing road conditions are described below.

New England Highway

The New England Highway dissects the middle of the lease in a southeasterly-northwesterly direction. The highway is the main link between Singleton and Muswellbrook and acts as a major route to both New South Wales and Queensland

destinations.

The highway is generally a divided and sealed high quality carriageway. An additional turning lane is provided along the southern approach to Rixs Creek Lane. Climbing lanes are provided on grades. The highway is single lane where it traverses the lease area.

Middle Falbrook Road

Middle Falbrook Road is a relatively narrow, undivided sealed carriageway. The road is generally sealed with a thin gravel pavement on a narrow carriageway with loose gravel shoulders. The road crosses the Main Northern Rail line via a level crossing approximately 5 km north of the New England Highway and 3 km to the north of the Rixs Creek lease boundary. This road services rural dwellings to the north although alternative routes are available.

Rixs Creek Lane

Rixs Creek Lane serves as an access route between the mine's surface facilities and the New England Highway. Both the Lane and its intersection with the highway have been upgraded to comply with development consent conditions since the commencement of mining operations on the site. This road is utilised by employees, general service and delivery vehicles, visitors and residents adjacent to the Lane.

2.13 LAND ZONING AND STATUTORY PLANNING CONTROLS

Development and landuse throughout the Singleton local government area is controlled by various environmental planning instruments at local, regional and state levels. A summary of those environmental planning instruments that are relevant to the Rixs Creek proposal are discussed below.

2.13.1 Singleton Planning Scheme Ordinance

According to the provisions of the Singleton Planning Scheme Ordinance, 1966, the coal lease is zoned Non-Urban 1(a). The objectives of this zone are to protect the use and efficiency of agricultural land whilst permitting appropriate development subject to suitable subdivision controls. Coal mining and ancillary activities are permissible forms of development, subject to the consent of Singleton Council, within the 1(a) Non-Urban zone.

2.13.2 Draft Singleton Local Environmental Plan, 1993

A new local environmental plan to replace the existing Singleton Planning Scheme Ordinance was placed on public display by Singleton Council on 29 April 1993. Draft Singleton Local Environmental Plan, 1993 has achieved Section 66 status under the Environmental Planning and Assessment (EP&A) Act, 1979, that is, it has been publically displayed but not yet gazetted. The draft plan designates the coal lease area as Zone No.1(a) Rural. Coal mining is a permissible form of development given the site's 1(a) Rural Zone within the draft plan.

2.13.3 Hunter Regional Environmental Plan, 1989

The Hunter Regional Environmental Plan, 1989 provides a statutory framework to guide and control the Hunter Region's growth and development. The Rixs Creek project is considered to comply with the stated objectives and policies for controlling development within that section of the plan entitled "Part 6 - Natural Resources". In particular, Objective 39 of the Plan states that the objectives in relation to planning strategies concerning mineral resources and extractive materials are to:

(a) *manage the coal and other mineral resources and extractive materials of the region in a co-ordinated manner so as to ensure that adverse impacts on the environment and the population likely to be affected are minimised;*

(b) *ensure that development proposals for land containing coal and other mineral resources and extractive materials are assessed in relation to the potential problems of rendering those resources; and*

(c) *ensure that transportation of coal and other mineral resources and extractive materials has minimal adverse impact on the community.*

The proposed development does not conflict with any of the landuse planning issues or strategies outlined above. The incorporation of comprehensive environmental planning, monitoring and rehabilitation programmes into the mine expansion reduces or eliminates any potential landuse conflict.

2.13.4 Hunter Regional Environmental Plan, 1989 - Heritage

The general aim of the Hunter Regional Environmental Plan, 1989 - Heritage is to conserve the environmental heritage (including the historic, scientific, cultural, social, archaeological, architectural, natural and aesthetic elements) of the region. Heritage aspects of the project are discussed fully in **Section 2.14**.

2.13.5 State Environmental Planning Policies (SEPPs)

Those SEPPs which are considered relevant to the proposed development include:

SEPP No.11 : Traffic Generating Developments The objective of this policy is to ensure that the Roads and Traffic Authority (RTA) of New South Wales is made aware of, and is given the opportunity to make representation in relation to certain types of traffic generating developments. The traffic generated by the coal mine will require assessment by the RTA.

SEPP No.34 : Major Employment Generating Industrial Development Under this policy the Minister for Planning will be the consent authority for major employment-generating industrial and labour intensive rural industrial development of state significance. The policy relates to those developments creating at least 20 post construction or full-time jobs or having a capital investment value exceeding $20 million. SEPP No. 34 is applicable to the proposed development.

2.14 SOCIAL AND ECONOMIC ASPECTS

2.14.1 Population

Rixs Creek Mine is a regional employer with its current workforce drawn from several local government areas (LGAs). As outlined in **Section 2.13.5**, 89 per cent of employees reside in the adjoining LGAs of Maitland, Cessnock and Muswellbrook, as well as in Singleton. These areas will be profiled to describe the mine's regional setting.

Table 2.2 shows the population change experienced by the four LGAs over the period 1976 to 1991, compared with the Hunter region as a whole. Singleton's population increased by 8 per cent during the last intercensal period, 1986 to 1991, a higher rate than that of the neighbouring LGAs and the Hunter region as a whole.

Singleton Council estimates the current population of the LGA to be in the order of 19,000 persons, of which approximately 63 per cent live in the urban area, and 37 per cent in rural areas (including villages). Based on the 1991 census, Singleton Council has projected population growth for each five year period to 2011 when the population is estimated to be 25,000 (Singleton Council, 1993).

TABLE 2.2
SINGLETON AND ADJOINING LOCAL GOVERNMENT AREAS
POPULATION CHANGE (1976 - 1991)

Statistical Area	Population				Population Change			Average Annual Rate (%)		
	1976	1981	1986	1991	1976/81	1981/86	1986/91	1976/81	1981/86	1986/91
Singleton	12,359	15,211	17,277	18,660	2,672	2,066	1,383	4.62	2.72	1.60
Cessnock	35,553	37,854	41,733	43,854	2,301	3,879	2,121	1.29	2.05	1.02
Maitland	36,002	39,938	44,315	46,667	3,936	4,377	2,352	2.19	2.19	1.06
Muswellbrook	11,520	12,978	14,892	15,117	1,458	1,914	225	2.53	2.95	0.30
Hunter Region	422,268	458,722	482,775	513,550	36,454	24,053	30,775	1.73	1.05	1.2

Source : Australian Bureau of Statistics

Table 2.3 shows these projected population increases.

TABLE 2.3
SINGLETON LOCAL GOVERNMENT AREA
POPULATION PROJECTION
1996 - 2011

	1996	2001	2006	2011
Population	20,300	22,900	24,000	25,000

2.14.2 Economic Activity

The late 1970s and early 1980s saw unprecedented growth in resource development and heavy industry in the Hunter. This included coal mining, electricity generation and aluminium smelting. Since 1982, the scale of development has slowed, but coal mining continues to play a significant role in the regional economy, especially mines in the Singleton - Muswellbrook area which produced 46 per cent of NSW Coal (NSW Department of Mineral Resources).

2.14.3 Employment

Table 2.4 shows the break-up of employment by industry sectors at the time of the 1991 census for Singleton and adjoining LGAs.

In Singleton in 1991, 19.9 per cent of the working population was directly employed in the mining industry, followed by the wholesale/retail trades with 14.8 per cent. The next largest areas of employment were public administration and defence with 12.4 per cent (reflecting the presence of the army base), community services with 10.8 per cent and agriculture with 8.0 per cent).

Manufacturing is a major employer in Cessnock and Maitland. Mining provides a low proportion of jobs for residents of Maitland, in contrast to the other three LGAs.

Muswellbrook and Singleton are more reliant upon agriculture, and Muswellbrook also has a higher proportion employed in electricity generation.

TABLE 2.4
EMPLOYMENT BY INDUSTRY IN 1991
SINGLETON AND ADJOINING LOCAL GOVERNMENT AREAS

Industry	Percentage of Workforce			
	Singleton	Cessnock	Maitland	Muswellbrook
Agriculture, forestry	8.0	2.6	2.7	9.2
Mining	19.9	14.1	4.4	15.1
Manufacturing	3.8	16.7	17.9	7.5
Electricity, gas, water	4.2	1.5	2.0	10.7
Construction	6.0	6.0	6.8	4.6
Wholesale/retail trade	14.8	16.5	19.2	14.6
Transport and storage	2.9	2.7	4.5	3.1
Communication	0.3	0.9	1.3	0.9
Finance, property and business services	6.1	5.4	8.6	6.6
Public administration, defence	12.4	3.1	4.0	3.1
Community services	10.8	15.8	16.3	10.7
Recreational, personal and other services	5.4	7.1	6.1	6.4
Not classifiable	0.3	0.2	0.2	0.1
Not stated	5.2	7.2	5.8	7.3
	100%	100%	100%	100%
Total Workforce (persons)	8,486	15,848	19,232	6,716

Source: Australian Bureau of Statistics

2.14.4 Unemployment

According to estimates by the Department of Employment, Education and Training (DEET, 1994) there were 823 persons unemployed within the Singleton LGA in the

December quarter of 1993 (the latest estimates available), an estimated unemployment rate of 8.3 per cent.

In the same period, the estimated unemployment rate in Maitland was 11.9 per cent (2,758 persons), Cessnock 17.7 per cent (3,518 persons) and Muswellbrook 8.6 per cent (669 persons).

The Upper Hunter has the lowest levels of unemployment in the region. The Hunter Valley Research Foundation (HVRF, 1994) expects that the large amount of proposed investment in the mining sector will probably ensure that this continues.

A considerable pool of experienced mine workers exists within commuting distance of the Rixs Creek Mine. The Northern District of the United Mineworkers Federation of Australia (UMFA) has approximately 700 retrenched workers registered (May, 1994). Of these, about 400 are production workers and 300 are tradespeople. The Australian Colliery Staff Association (ACSA) has approximately 160 retrenched technical/professional staff registered in the Northern District (May, 1994). Many of these personnel are resident in the Hunter.

2.14.5 Place of Residence of Rixs Creek Workforce

The current workforce of Rixs Creek Mine consists of 40 production and engineering personnel and six staff. The demographic break-up of the workforce on a permanent residency basis indicates a spread through seven LGAs. Table 2.5 shows the number of employees by residential location from the end of 1992 to the end of May 1994.

The largest number of employees (41 per cent) reside in Maitland LGA, probably reflecting the prior existence of the Bloomfield underground mine near East Maitland.

TABLE 2.5
RIXS CREEK EMPLOYEES BY RESIDENTIAL LOCATION

Local Government Area	Number of Employees		
	End of 1992	End of 1993	End of May 1994
Singleton	5 (21%)	7 (17%)	11 (24%)
Cessnock	8 (33%)	8 (19%)	8 (17%)
Maitland	10 (42%)	18 (43%)	19 (41%)
Muswellbrook	1 (4%)	4 (10%)	3 (7%)
Newcastle		3 (7%)	3 (7%)
Dungog		1 (2%)	1 (2%)
Murrurundi		1 (2%)	1 (2%)
Total Workforce	24	42	46

2.14.6 Housing

Singleton's growth has been concentrated in the Singleton Heights area, and in Hunterview Estate to the east of Bridgeman Road where new subdivision development has responded to demand for serviced allotments.

As well as new housing, there is a continuing market in rental housing, purchase and in-fill housing in the older established areas of the urban centre.

Rural residential development, particularly on the outskirts of Singleton township, provides an alternative to urban living.

2.14.7 Community Services

Health Services

Health services are provided throughout the whole of the Hunter Region by the Hunter Area Health Service, including community health and dental services.

Singleton District Hospital has 72 beds, and provides general and obstetric services, including acute and elective surgery practices. Specialised health care professionals located in the Lower Hunter are available on a visiting basis.

There are two nursing homes and hostels which cater for aged care services.

Education

Singleton LGA has eight primary schools, two high schools and a TAFE college. Primary and high school enrolments have grown steadily in both rural and urban areas.

Child Care

With the opening of the Multi-purpose Child Care Centre at Hunterview Estate, Singleton has adequate child care spaces for the 0 to 4 age group. The new centre and existing pre schools provide a total of 120 pre school places and 68 day care places. There is also a family day care programme which is currently meeting demand.

The Singleton Youth Centre, with one full-time and one part-time employee, provides activities for older children, particularly in the 13 to 19 age group.

Out of hours school care may, in the future, be provided at the Multi-purpose Child Care Centre.

2.15 CULTURAL ASPECTS

2.15.1 Aboriginal Heritage

An initial archaeological survey of the Rixs Creek area, undertaken in 1981 in preparation of the initial EIS for the mine (Brayshaw 1981), identified 18 open sites and several isolated finds throughout the lease. The location of these sites and the survey routes are shown in **Figure 13**.

Initial mining plans indicated that finds at Sites 3, 4, 5, 6, 7, 8 and 11 would be affected by mining and clearing for surface facilities. A supplementary archaeological report was prepared during 1982 (Brayshaw 1982). Detailed descriptions of artefacts at open sites and the isolated finds likely to be affected by mining were provided. Subsequent to these investigations Consent to Destroy applications for these seven sites were forwarded to the NSW National Parks and Wildlife Service (NPWS).

The Service requested that salvage work at the sites be undertaken prior to the granting of Consent to Destroy. This salvage work involved the collection of artefacts from Sites 3, 5, 7 and 11 and the recording of artefacts from 4, 6 and 8. The results of the work, which was undertaken with local Aboriginal involvement, are contained in Brayshaw (1983) and Consent to Destroy was granted for all of these sites.

The proposed expansion of Rixs Creek open cut has the potential to affect sites 10, 17 and 18 as originally identified by Brayshaw (refer **Figure 13**). Enviros ciences Pty Limited, in conjunction with the Wanaruah Local Aboriginal Land Council, undertook a resurvey of these sites to reassess them in the light of current archaeological models of the Hunter Valley and conservation status of the sites.

A report on the findings of this supplementary survey is presented in **Appendix 7**. The results from the survey indicate that the Brayshaw Site 10 could not be relocated.

However, two new sites: Rixs Creek 1 and Rixs Creek 2 were identified in the general area, closer to Rixs Creek. In the area identified as containing the Brayshaw Sites 17 and 18 a total of six sites were identified and named Granbalong 1-6. Granbalong 2 corresponds to Site 17 and Granbalong 6 to Site 18. The location of all of these sites is shown in **Figure 13**.

The survey concluded that the Granbalong Sites 1-6 have suffered considerable disturbance and are highly degraded. These sites offer little Aboriginal, scientific or historical significance. It is therefore recommended that "Consent to Destroy" applications be lodged for these sites.

The area encompassing the sites Rixs Creek 1 and 2 and possibly site 10 is recommended to be set aside for future study/assessment prior to such time that Bloomfield Collieries are ready to disturb the area. Rixs Creek 1 and 2 have both been assessed as having high archaeological and Aboriginal significance and represent the potential for further study.

2.15.2 European Heritage

Items of European heritage significance that occur on the lease were thoroughly investigated and documented in the initial EIS for the mine. This included the relics of a coking operation located adjacent to Rixs Creek Lane (refer **Figure 13**).

The Rixs Creek coke ovens and associated works are the subject of an Order made under Section 130(1) of the Heritage Act 1977. This order affords protection to buildings or works which on further investigation may be found to be of sufficient heritage significance to warrant more permanent conservation arrangements.

The Rixs Creek coke ovens are also classified by the National Trust of Australia and are included in the Trust's register. The register lists those buildings, sites and areas which, in the Trust's opinion, fall within the definition of places which are components of the natural

or cultural environment of Australia, that have aesthetic, historic, scientific or social significance or other special value for future generations, as well as the present community.

The Rixs Creek site features the relics of a coking operation conducted in the late nineteenth century. Old workings of a number of collieries associated with the coking operation are evident. The site include:

- Two batteries of coke ovens.
- Three closed underground mines.
- A number of embankments which once supported rail skips used on the site and also the rail trucks which transported the coke to market via the Main Northern Railway.
- Two large mullock heaps and the remains of wooden structures.

One battery of coke ovens consists of 26 "beehive" type ovens, thought to be constructed in the early 1870s and used up until 1919. The second battery consists of eight "beehive" ovens and four "arched" or "culvert" ovens, the later being of a more advanced design. It has been estimated that this group was constructed in the mid 1880s and ceased operations by about 1905.

The heritage significance of the site has been well documented by a number of authors (McCarthy and Brassil, 1982; Radmall, 1982; McCarthy, 1980; and Stewart, 1982). In general it has been agreed that the significance of the site relates to the type of coke ovens, the importance of the site in the industrial development of NSW and its value as a technological and historic relic.

Prior to commencement of mining operations on the Rixs Creek lease a buffer area of approximately 14 ha was established to protect the coke oven complex. The buffer area is fenced and precautions are taken to protect the area including monitoring of blasts to ensure the structural integrity of the coke ovens as well as erosion control measures.

To comply with development consent conditions for the mine, a conservation plan in respect of the coke ovens protection area, has previously been prepared and submitted to both Singleton Council and the Heritage Council of NSW. This plan detailed the curtilage of the area, protection of the historic artefacts and conservation of the area.

2.16 VISUAL ASPECTS

2.16.1 Visual Character

Since early settlement much of the Upper Hunter Valley has been cleared for grazing, agriculture and timber as well as for urban development and coal mining projects. Tree cover ranges widely from areas of regeneration with forest through to open woodlots and forests dominated by Eucalypts with minimal understorey vegetation and finally to mature woodlands with structural variations, particularly along watercourses.

The Rixs Creek lease area is comprised of gently undulating land adjoining Rixs Creek in the southern and eastern parts and hilly towards the northern boundary. The land rises beyond the lease area to the east and west to form prominent ridgelines. The ridgelines to the east separate the catchment of Rixs Creek from the new areas of Singleton Heights. The New England Highway follows a spurline of the eastern ridge to the northwest.

The initial development of the Rixs Creek coal mine has incorporated the establishment of bunds and tree planting along Rixs Creek Lane and the New England Highway. The open cut mining area, although limited up to the present, has resulted in the unavoidable modification of the topography of the site and created additional identifiable landscape components in the area. Extensive regrowth of native species has occurred in the five year period since the commencement of construction and mining development works.

The eastern corner of the intersection with Rixs Creek Lane and the New England Highway has experienced substantial regrowth of native species, particularly Ironbarks.

Similar regrowth has occurred at the western intersection of Middle Falbrook Road and the New England Highway and continued along the ridgeline in a northerly direction.

The southern side of the existing New England Highway at the eastern extremity of the lease has been previously disturbed by gravel quarrying. Following the cessation of this activity, this area has also experienced substantial regrowth of Spotted Gums, Narrow-leaved Ironbarks and Wattles. This area is also being rehabilitated, in conjunction with the commencement of mining in the southern section of the lease. The regeneration is being reinforced with the instigation of direct seeding to create visual screening and treelots.

The northern section of the lease adjacent to the Main Northern Rail line has also experienced native regeneration that is creating visual screening. The northeastern face of the overburden dump in this area will be rehabilitated in the spring of 1994 incorporating direct seeding of Eucalyptus, Casuarina and Wattle species.

It has been the practice to maximise the retention of existing tree lots around the infrastructure components of the mine site. The location of the coal preparation plant, office and workshop to the north of a substantial ridgeline running east-west through the lease, effectively screens these major components from roadways, urban areas and the Main Northern Rail line.

2.16.2 Landscape Units

The visual features which are entities within the area include the ridges and identity hills, forested areas, drainage lines, transport routes, cleared grazing land and areas of mining development. The basic features of these units are described below.

Woodland Areas and Woodland Regeneration

> The woodland areas are mainly located on steeper land which in the past was less suitable for grazing and mining purposes. Woodland is visually prominent within the lease area. Areas of the site, particularly those which have had grazing pressure

removed, are vegetated with Ironbark and Spotted Gum saplings. In conjunction with the mature woodland, areas of regeneration present structural and textural diversity.

Ridgelines and Identity Hills

The ridgelines create a sense of enclosure, and form the Rixs Creek basin and a skyline to views from the lower portions of the study area. Clearing has been undertaken on spurs and the lower slopes of ridgelines. This emphasises the rolling to undulating terrain of the area.

Grazing Orientated Rural Landscape

The majority of the lease is within this category. Significant regeneration is occurring on previously cleared land now owned by the Company, as grazing has been excluded. Land still being grazed has little regeneration with semi-improved pastures being dominant.

Mining Operations, Infrastructure

The extraction of the coal resource in the lease area by open cut methods, together with the provision of infrastructure, internal roads, stockpiles and the rail loading facility has resulted in a prominent modification of the topography of the site. Although the total area of disturbance is small at any one time and rehabilitation has proceeded concurrently with mining, the exposed nature of the mining site is visually obtrusive.

Creeks and Drainage Lines

The Rixs Creek and tributary flow lines form the basis of the drainage network of the area. A small portion of the lease in the northwest sector drains to an intermittent creek which joins the Hunter River to the north of the Maison Dieu settlement.

Trees growing along, or in close proximity to these watercourses, visually emphasise their location. This feature is more pronounced on the western side of the New England Highway where Swamp Oak predominate.

Transport Routes

The major transport routes passing through or adjacent to the area are the New England Highway and the Main Northern Railway. Secondary transport routes include Middle Falbrook and Maison Dieu Roads.

The New England Highway is a dominant element within the coal lease area. It physically and visually dissects the site and can be seen from many vantage points.

Traffic increases the perceived impact of the highway. The newly constructed road bridge over the highway, linking the north and south open cut areas also contributes to the visual aspects of the area. Similarly the Main Northern Railway is a prominent feature, particularly from within the eastern portion of the site. The presence of the railway together with the new rail loop and loading facility is further accentuated when trains pass through the site.

Due to lesser traffic volumes and subsequent lower design requirements, the routes of Middle Falbrook and Maison Dieu roads relate quite closely to local topography. Visual prominence is high only when viewed from foreground distance zones.

2.16.3 Scenic Quality

The basic premise of visual quality assessment is that all landscapes have some value but those with the most variety or diversity have the greatest potential for high scenic value.

The coal lease area has no distinctive visual characteristics which highlight it in a subregional context. The site which is essentially a mining/rural landscape is characteristic of the Upper Hunter Valley and is considered to have moderate scenic status. Certain landscape types, which include the watercourses, ridgelines and identity hills have a higher scenic status.

SECTION 3

EXISTING MINING OPERATIONS

3.1 PRESENT MINING OPERATIONS

Rixs Creek Open Cut commenced coal production in July 1990 in an area adjacent to the New England Highway. This site had previously been mined by underground methods and the surface area had been disturbed by gravel quarrying. Mining was carried out using bulldozers and scrapers to move overburden. Coal was then loaded onto road trucks for transport to Bloomfield Colliery at East Maitland for washing and then railed to port.

As the mine progressed deeper in this area massive sandstone was encountered above the Barrett Seam. Due to the competency of this rock shelf it became necessary in May 1991 to commence blasting to fracture overburden. However, poor resource recoveries and loss of coking properties of the coal within the old underground workings, accompanied by water ingress forced the relocation of the operations to approximately the Year 6 area designated in the EIS prepared by Croft and Associates (1989).

Mining is currently taking place towards the northern boundary of the lease, between the site infrastructure area and Middle Falbrook Road (refer Figure 2). In addition to this Rixs Creek are mining a section of the lease on the southern side of the New England Highway to the east of Rixs Creek. A bridge has been constructed over the Highway to facilitate mining of this area.

3.2 MINING METHOD

The Rixs Creek Lease is located within the Foybrook Formation of the Wittingham Coal Measures. The seams being mined in ascending order are the Hebden, Barrett, Liddell, Arties, Pikes Gully and Lemington seams with the bulk of the coal coming from the Barrett Seam.

The seams vary widely throughout the area and often occur as several dispersed splits. A particular characteristic of the coal beds within the lease area is their variability. The coal is of consistently high quality, however, the beds are generally very banded, with the

content of this band material varying widely from place to place and seam to seam.

Mining is carried out using scrapers, loaders and trucks. Table 3.1 lists all equipment currently utilised on the site.

TABLE 3.1
EQUIPMENT CURRENTLY USED IN RIXS CREEK OPEN CUT

Item	Number
Caterpillar D9	1
Caterpillar D11	1
Caterpillar 994 front-end loader	1
Caterpillar 992 front-end loader	2
Caterpillar 980 front-end loader	1
Caterpillar Tiger bulldozer (690B)	1
Caterpillar 793 dump truck	1
Caterpillar 789 dump truck	1
Caterpillar 16G grader	1
Caterpillar RR250 (road profiler)	1
Caterpillar 657 scraper	1
Caterpillar 660 scraper	3
Komatsu 785 dump truck	2
DJB watercart	2
Drill 45R	1
Auxiliary Equipment:	
Lighting plants	5
Service vehicle	1
Alternators	3
Mobile diesel pumps (water)	3

Source : Rixs Creek Colliery

Scrapers and dozers remove topsoil in advance of the mining face. Where possible this is transferred directly to reshaped backfill areas or is otherwise stockpiled until needed. Overburden is drilled and blasted to achieve the desired fragmentation. Spoil is removed using a large front-end loader and rear dump trucks.

At the commencement of mining in the present area an out-of-pit spoil dump was established between the pit and the Main Northern Rail Line. Spoil was dumped on an area of high overburden to coal ratio material between the economic limit of the Barrett Seam and the oxidation limit of the Upper Liddell Seam. This dump has now been

completed and reshaped and is currently being rehabilitated.

Overburden dumping currently takes place in-pit and has been utilised in the construction of a new tailings dam. Spoil has been dumped adjacent to the low wall edge of the pit and shaped to form a dam wall and new drainage alignment for Rixs Creek. Some spoil has also been placed on the highwall side of the pit to establish a drainage line around the dam.

Spoil dumps on the Rixs Creek site are formed in lifts of generally 5 m and shaped to blend with the current landform. All slopes are less than 10 degrees except for acoustic and visual bunds which have slopes less than 14 degrees.

The coal seams are ripped and loaded into rear dump trucks for transport to the site's coal handling facilities. The seams are selectively mined so that parting material within the coal seam which is greater in thickness than 200 mm is removed by dozing and front-end loader and trucks. Coal beds are mined if they are greater than 200 mm thick and have a run of mine (ROM) ash content of less than 45 per cent.

Using this criteria for selecting mining seam sections it can be seen that non carbonaceous bands of up to 150 mm thick can be included in the ROM coal which requires removal by the coal preparation plant. A feature of the Barrett Seam on the site is the numerous bands of which only 25 per cent are able to be removed during the mining process. The remaining bands constitute the reject which are removed as part of the coal beneficiation process.

Mining operations in the Southern Pit are due to commence in 1994. Spoil from the initial box cut will be used to shape and rehabilitate an adjacent gravel quarry. Additionally an acoustic attenuation bund will be constructed adjacent to the mining area. This bund will be an extension of an existing ridge line. Coal production in this area of the lease will utilise similar mining procedures to those implemented in the northern part of the lease.

3.3 COAL HANDLING AND PREPARATION

3.3.1 Raw Coal Handling

Raw coal is carted by rear dump trucks out of the pit and dumped either directly into a 600 tonne receival hopper or stockpiled on a 30,000 tonne capacity ROM stockpile area located adjacent to the hopper. Stockpiled coal is then fed by front-end loader into the hopper. From the base of the dump hopper two plate feeders feed coal onto a ROM coal belt which either directly feeds the coal preparation plant if the material is wet or feeds coal to a screen and rotary breaker. The sizing screen is fitted with a 50 mm aperture deck. Minus 50 mm passes through the screen and the oversize is fed to the rotary breaker. This reduces the size of the coal and removes a proportion of oversize reject material which is conveyed separately to a stockpile and removed by truck.

3.3.2 Coal Preparation Plant

The coal preparation plant at Rixs Creek operates at a maximum raw coal feed rate of 400 tph. The minus 50mm x 1mm raw coal from the primary raw coal sizing and breaking system is further sized on screens and in classifying cyclones and each size fraction is cleaned in separate circuits.

Heavy medium cyclones treat the minus 50 + 1.0 mm fraction. Spirals clean 1.0 + 0.15 mm. The washed products are dewatered in centrifuges and are then conveyed to a 1,000 tonne bin.

3.4 REJECT HANDLING AND DISPOSAL

3.4.1 Quantities and Composition of Rejects

On average 35 per cent of the raw coal fed to the preparation plant becomes reject material. Approximately one half of the material consists of fine rejects, requiring disposal

as tailings. At a raw coal production rate of 800,000 tpa, approximately 200,000 tonnes of tailings and 140,000 tonnes of coarse rejects are generated annually.

3.4.2 Reject Disposal

Coarse Reject Disposal

Coarse reject from the coal preparation plant reports to a 600 tonne reject bin. From this bin it is trucked to the current open cut working area to be disposed of within the spoil material. The transport of this material is via return loads in rear dump trucks after delivery of ROM coal to the raw coal stockpile. Coarse reject disposal in this manner is controlled by the production supervisor, with tip areas being allocated on the basis of environmental constraints, the potential of spontaneous combustion and the stability of tip faces within the spoil area. All carbonaceous and reject material is covered by 6 m of inert overburden material before the spoil area is shaped and rehabilitated.

Fine Reject Disposal

The fine reject consists of a slurry of clay, silt and composite mineral and coal particles less than 0.5 mm in size mixed with water to a pulp density of 25 per cent. This slurry is pumped from the underflow of the tailings thickener through a pipeline to a tailings dam. The pipeline is 1.2 km long and is constructed from 12 m long sections of 225 mm diameter PVC pipe weld jointed. The pipeline route is shown in **Figure 14** and is located within a controlled catchment area so that any accidental breaks on the line will flow into water quality control dams. The transport of tailings by pipeline in this manner is also safeguarded by:

- regular pipeline inspections
- routine thickness testing
- prompt changes of worn pipes
- the route being located within view of passing personnel

Tailings emplacement area No. 2 is currently in use. Area No. 1 reached its design capacity in June 1994 and is now to be capped and rehabilitated.

The current tailings emplacement area (refer **Figure 14**) involves the filling and rehabilitation of the abandoned mining area immediately south of the Great Northern Railway. This area is bounded on the west by a solid highwall that marks the economic pit limit, to the north by a highwall where the coal seams split and disintegrate and to the east and south by rehabilitated spoil.

"Return" water is decanted from the emplacement area and pumped back to the closed "dirty water" system that feeds the coal preparation plant. Water is still pumped from the abandoned shaft (associated with the old underground workings near the New England Highway) as top up water for use in the coal preparation plant.

The emplacement area is fenced, signposted and routinely inspected to monitor the system. No. 2 Area has an estimated life of 10 years (at planned production levels). At the completion of this dam it is anticipated that a new tailings dam will need to be constructed on the site in conjunction with current mining plans. This will be subject to all relevant approvals and be controlled through the open cut application process.

3.5 TRANSPORT OF PRODUCT COAL

Clean coal is transported to the coal loading facility by road transport vehicles over approximately 2 km of maintained gravel roads

Washed coal is dumped in a 20 tonne receival hopper from where it then reports to a conveyor and gantry system. A stacker conveyor then transfers the coal to a stockpile area of 185,000 tonne capacity. The coal is stacked over and adjacent to a reclaim tunnel that is fed via dump hoppers utilising live loading, front end loaders and dozers. The clean coal is then conveyed to a 1,800 tonne bin located over the rail loop.

The loading system is rated Category 5 by the State Rail Authority (SRA) and is capable of loading 100 tonne wagons of 84 unit length. The rail loop and loading system is capable of a total throughput of 10,000,000 tonnes per annum.

3.6 CURRENT PRODUCTION AND MARKETS

Rixs Creek Open Cut currently produces approximately 800,000 tonnes per annum of raw coal amounting to a saleable production rate of 500,000 tonnes. All of this coal is currently sold to export markets.

3.7 SURFACE FACILITIES

Figure 2 shows the existing infrastructure of permanent buildings, roads, dams, bridges and associated elements.

A steel portal frame office, bath house and workshop complex is located adjacent to the coal preparation plant and storage building. All buildings are clad and roofed in metal except for the office/bath house which is clad externally in masonry.

The permanent road system connects the southern mining area to the coal loading facility and incorporates two pre-stressed concrete girder bridges. A tar sealed road also connects the office/bath house facility with Rixs Creek Lane. Permanent haul roads interconnect the open cut mining operation with the coal preparation plant, workshop and the main north-south haul road.

3.8 EXISTING WATER MANAGEMENT

3.8.1 Introduction

The water management system employed at the Rixs Creek Mine has been designed with the primary objectives of:

- the segregation of uncontaminated and contaminated waters on site;
- priority given to the safe on-site disposal of contaminated water; and
- the elimination of dry water discharges of contaminated water.

The control systems employed to achieve these objectives are shown on **Figure 14** while **Figure 15** provides a flow chart for the operation.

Water management at Rixs Creek is discussed below in terms of uncontaminated, contaminated and potable water systems.

3.8.2 Uncontaminated Water

Runoff from undisturbed areas is directed away from the mining operations and infrastructure through diversion banks. Diversion banks and channels direct runoff directly into natural water courses or into clean water dams. Water from clean water dams is available for mining operations in emergency situations when contaminated water is not accessible, however, for the life of the mine to date this has been necessary on only one occasion.

Clean water dams overflow into natural drainage systems.

Diversion banks and channels have been constructed to the west and east of the active mining area to eliminate the runoff of uncontaminated water into this area. These channels are shown on **Figure 14** and are constructed at 0.5 - <1 per cent gradient.

The diversion channel to the east of the mining area is directed into Clean Water Dam 4. This dam also accepts clean water diverted around the east of the surface facilities area. Overflow from Clean Water Dam 4 is directed into Rixs Creek to the southwest via a channel constructed through rehabilitated land.

The diversion channel to the west of the existing mining area directs clean water into the existing channel of Rixs Creek after treatment in a sedimentation dam.

The clean coal stockpile and rail loadout bin area is situated in the northward draining catchment of Blackwall Creek. Diversion banks and channels to the west, south and east of the clean coal stockpile area direct water around this area and into the natural drainage network.

3.8.3 Contaminated Water

All runoff from disturbed areas is contained in dams with capacity to contain at least all runoff from a 1 in 10 year storm event for 1 hour duration, or collected in pits. The total dirty water storage currently available in dams is approximately 70 ML. This capacity is large compared to the catchment size the dams cater for, and ensures that there is little chance of overflow of the system. Most water contained in these dams is pumped at controlled rates.

Priority is given to the use of contaminated water in mine operations.

Dirty Water Dam 1 is situated south of Clean Water Dam 4 and provides water for use in the coal preparation plant. This dam has a capacity of 35,000 m^3 with 1.0 m of freeboard, and accepts all runoff from the workshop, ROM stockpile and coal preparation plant areas, groundwater and surface runoff pumped from the pit area, and supplementary water for the coal preparation plant pumped from existing old underground workings.

The runoff from the coal preparation plant, workshop and ROM stockpile areas is directed through oil and grease traps, baffles and siltation dams to remove sediment prior to entering Dirty Water Dam 1.

The water pumped from the old underground workings is held in Dirty Water Dam 2 as a staging post prior to the transfer to Dirty Water Dam 1.

Fine washery rejects are transferred by pipeline to the tailings dam established in an old open cut pit, south of the Main Northern Rail Line. Decanted water from the tailings dam

is also transferred for reuse to Dirty Water Dam 1.

Dirty Water Dams 1 and 2 are provided with truck watering points to supply water for haul road and in-pit dust suppression. Dust suppression sprays for the ROM coal stockpile area are supplied from the coal preparation plant clarified water tank.

Runoff from the clean coal stockpile and rail load out bin is captured and directed via sedimentation traps to two dirty water dams in the east of the area and reused for dust suppression. A connection with Dirty Water Dam 1 allows the transfer of water in excess of dust suppression requirements to the washery system or for the supply of additional water to the clean coal stockpile area in times of a local deficit.

Runoff from haul roads throughout the site is contained in a series of small settling ponds with the capacity to contain all runoff from a design storm event.

3.8.4 Potable Water

Potable water demands for the bath house and office complex is supplied by water carriers and stored on-site. Requirements for this water amount to a total of approximately 20,000 litres per week. Waste disposal consists of an approved septic tank and evaporation pond system.

3.8.5 Water Balance

A water management flow chart for the current water management at Rixs Creek Mine is presented in **Figure 15**. This diagram illustrates all major water storages, sources of water supply, sources of water demand and the connections available and utilised in the system.

The water management procedures in place at the mine provide for the total reuse of all minewater under normal rainfall conditions. Demands for water at the mine exceed supply from runoff and pumpout of the pit, and the balance for the system is provided by the

pumpout of water from underground workings on an as-needed basis.

Water supplies on site comprise runoff from surface facilities, the clean coal stockpile area, the open cut area and groundwater collected in the pit. Water demands comprise dust suppression spraying and losses from washery output in the form of moisture in product coal and coarse reject and the unrecoverable tailings moisture content. Evaporation from the surface of all water storages also constitutes a loss from the system.

Calculated annual water volumes shown on **Figure 15** indicate a deficit of approximately 6 ML under normal rainfall conditions. This demand is satisfied by pumpout from underground workings.

Through the practical operations of the mine to date a deficit of 6 ML appears conservative, as there is a regular demand for significant volumes of underground water. An over-estimate of water supply may be present in the quoted figures for groundwater and for runoff into the pit.

Rixs Creek Mine holds an EPA water discharge licence, however, the mine has had no need to exercise this option since early 1991, at a stage when the water management system was not completed. A total of approximately 11 ML was released off site under licence conditions up to that time.

The efficient operation of the water management system since early 1991, and the balance achieved by the underground water supply has ensured nil discharge conditions from that time onwards.

Pumpout of underground water is preferred as a supply for site requirements, however, the clean water contained in Clean Water Dams 2, 4 and 6 is available in emergency situations to make up short term deficits. There has been a requirement to draw upon the clean water supply in mine operations to date of a minor nature of approximately 10 ML.

3.9 REHABILITATION

3.9.1 Introduction

Recontouring, topsoil handling and revegetation techniques are generally well established at Rixs Creek Mine and are achieving the primary objectives of erosion control and reinstatement of land capability. The basic objectives of the rehabilitation programme, applied throughout the lease, are:

- to establish post-mining surfaces and a vegetation cover which ensures the pre-mining stability, capability and potential productivity of the site is achieved;
- to return the land to a condition suitable for a range of post-mining land uses, which takes into account the proximity of the site to the township of Singleton and the possible demands for development likely to be imposed on it in the future;
- to create new landforms to the north and south of the New England Highway which accommodate all overburden spoils produced in the mining and coal preparation plant rejects, and merge imperceptibly with adjoining undisturbed landforms.
- to reinstate a viable drainage network on the site which is hydrologically stable and incorporates erosion controls and sediment collection dams which effectively isolate the rehabilitated areas from adjoining areas;
- to repair erosion damage and replace areas of grass, trees and shrubs which die or do not grow.

While it is the intention of the Company to return the land to a condition suitable for a range of post mining land uses it is proposed in the short term to establish the area for grazing. This land use would be in accordance with the existing Rural Land Capability Classification of IV and V (refer **Section 2.3**).

3.9.2 Rehabilitation Techniques

The rehabilitation process incorporates direct seeding of pasture grasses and tree species, as well as the use of tube stock in designated areas for screening and beautification.

Prepared areas are sown with a pasture mixture to establish a cover, thereby stabilising the soils and reducing the possibility of dust emissions. Tree lots are incorporated in the rehabilitation scheme to provide a diversity of vegetation and to enhance the aesthetics of the completed landscape. The total tree density achieved with scattered lots throughout the site exceeds that which existed in the pre-mining environment, which had been extensively cleared.

All rehabilitation is conducted according to the mine's consent conditions and standards set out by the Department of Mineral Resources. Progressive backfilling of the working area is undertaken on a constant basis, with reshaping and revegetation then carried out at the appropriate season.

During 1992 and area of out-of-pit dump adjacent to the current working area was used for a rehabilitation research project. The spring sowing of 4 ha was undertaken utilising sewage sludge, from the Hunter Water Corporation, as a trial to assess the qualities of sludge as a topsoil substitute and also as a potential fertilising and soil conditioning agent.

Pasture germination in this trial area has been good and monitoring is continuing to provide more data for the assessment of the project.

3.9.3 Rehabilitation Progress

Progressive rehabilitation of disturbed areas has been undertaken since the commencement of mining operations.

The initial mining area adjacent to the New England Highway has been completely reshaped and rehabilitated. Rehabilitation works are ongoing on the initial out-of-pit dump created by spoil from the box cut that was excavated to commence mining operations in the present northern area.

Summaries of rehabilitation progress at Rixs Creek are contained in the Annual

Rehabilitation Reports prepared annually by the Company for submission to the Department of Mineral Resources. These reports detail the area of land disturbed, reshaped and rehabilitated in each reporting period. To the end of June 1994 a total of 138 ha of land has been disturbed as a result of the Rixs Creek open cut operation (including infrastructure). Rehabilitation has been implemented on approximately 80 ha of this disturbed land utilising a combination of pasture and direct tree seeding. Approximately 73 per cent of disturbed land, exclusive of land containing permanent infrastructure has been rehabilitated to date.

3.10 WORKFORCE AND MINE WORKING HOURS

Initially the Rixs Creek operation was day shift only with a permanent workforce of 10 personnel. A two shift operation commenced during May 1991, at which time the number of employees stood at 14. During 1991 to 1993 the workforce was progressively increased and currently stands at 46. A third shift was introduced in October 1993 and the mine currently operates on a three shift basis.

At present no coal haulage within the lease can take place before 6.30 a.m. or after 8.00 p.m. Monday to Friday. No mining can be undertaken on weekends or on public holidays.

3.11 WASTE MANAGEMENT PROCEDURES

3.11.1 Domestic and Process Waters

Waste waters generated on site consist of domestic wastes from bathhouse and associated amenity areas and trade wastes from the workshop and mine vehicle washdown bay.

Domestic wastes pass through a septic disposal system previously approved by the local authorities. The septic tank forms a primary and secondary sedimentation process with solid wastes being processed by anaerobic bacteria. Effluent then passes to maturation

ponds prior to disposal by evaporation and land irrigation.

Trade wastes pass through oil arresters to remove hydrocarbons. Oil is then directed to the waste oil tank which also directly receives waste oil from mine equipment, and thereafter is removed for recycling by waste oil collectors. The water is then supplied to Dirty Water Dam 2 for recycling through the coal preparation plant.

3.11.2 Solid Wastes

Scrap metal is currently collected for recycling on a regular basis.

Discarded rubber tyres are used on site wherever possible for the protection of the base of concrete plinths and metal columns that are located in areas where heavy vehicles are operating. Surplus tyres and those tyres that are not suitable for reuse are disposed of progressively in the void of the mining process. The number of tyres disposed of simultaneously is contained to a maximum of six to reduce the bulk. The void is then progressively backfilled with overburden and rehabilitated in the normal process.

3.12 ENVIRONMENTAL MONITORING PROGRAMMES

3.12.1 Dust Monitoring

Envirosciences Pty Limited maintains a dust monitoring programme for Rixs Creek Mine. Monthly results are obtained from a total of 27 dust gauges located within and adjacent to the lease. Suspended dust is also recorded in three high volume air samplers. Results of the monitoring programme are discussed in **Appendix 9**.

3.12.2 Water Monitoring

Australian Coal Industry Research Laboratories Ltd (ACIRL) maintains a water monitoring programme for the Mine. A total of six sites are monitored. Three of these are sampled

twice per month and the remaining three are sampled monthly. The results of this sampling are given in **Appendix 9**.

3.12.3 Noise and Blast Monitoring

Rixs Creek Mine personnel monitor and report on noise levels at four locations surrounding the mine on an annual basis. Each site is monitored continuously over a 72 hour period. The results of this monitoring are discussed in **Appendix 9**.

Production blasts began on the Rixs Creek site during May 1991. Blasts have been measured for vibration and overpressure at various locations including:

- Rixs Creek Lane
- Coke Ovens
- Singleton Heights
- Middle Falbrook Road
- Bridgeman Road
- Maison Dieu Road

Specific monitoring locations are dependant upon the actual blast location.

SECTION 4

PROPOSED AMENDMENTS TO MINING OPERATIONS

4.1 GEOLOGY AND COAL RESOURCES

4.1.1 Geology

The coal bearing strata within the Rixs Creek Lease belong to the Wittingham Coal Measures of the Singleton Super Group. **Figure 16** shows the principal seams to be mined.

The Singleton Super Group consists of coal seams interbedded with various sequences of mudstones, siltstones, sandstones and conglomerates, with occasional persistent marker bands and beds of tuffaceous claystones. The Singleton Coal Measures are bounded to the north and east of the Hunter Valley by a major regional fault known as the Hunter Thrust system. East of this fault older volcanic and sedimentary rocks are exposed by uplift and erosion and the coal measures are mainly truncated by these in this direction. Towards the western margins of the Hunter Valley, the coal measures are generally conformably overlain by the younger rocks forming the steep scarps along the western flank of the valley.

The Singleton Super Group has been subdivided into Wollombi and Wittingham Coal Measure sequences. It is this lower sequence that contains virtually all of the economic coal seams worked so far in the Singleton area. The Wittingham Coal Measures are up to about 1,200 m thick and it is the coal seams towards the base of this sequence that outcrop and become mineable in the Rixs Creek area.

At the base of the coal measures a distinctive formation, known as the Saltwater Creek Formation, represents a shoreline deposit separating the underlying marine sediments, called the Maitland Group, from the terrestrial sediments of the basal coal bearing sequence of the Wittingham Coal Measures, designated the Foybrook Formation.

The Saltwater Creek Formation is significant because it not only marks the limit of coal bearing strata, but it also contains a massive, erosion-resistant sandstone bed called the

Caswell Sandstone. This sandstone forms the prominent ridge separating the open cut mining operation from the Singleton Heights residential areas situated to the east.

Within the area to be mined, the coal seams in ascending order from the base of the coal measures includes the Hebden, Barrett, Liddell, Arties, Pikes Gully and Lemington Seams.

The seams vary widely throughout the area and often occur as several dispersed splits. Altogether the coal sequence is represented by some thirty well recognised separate coal beds which converge together in different combinations in different parts of the area to yield the various mineable seam sections.

The coal measure strata are influenced by structures in the vicinity of the Rixs Creek Lease area. These structures, known as the Rixs Creek Syncline and the Camberwell Anticline, locally determine the disposition of the coal seams and their outcrops. The Rixs Creek Syncline is typically asymmetric (refer **Figure 16**) with steeply inclined dips in the order of 40 degrees or more towards its western flank.

4.1.2 Coal Reserves and Resources

The total in-situ reserves in the proposed mining areas, outlined in **Figure 3** are 82.6 Mt. Total product coal has been estimated to be in the order of 50 Mt. **Table 4.1** identifies overburden, in-situ and product coal volumes for the project on a pit basis.

TABLE 4.1
RIXS CREEK COAL RESERVES

Pit Number	Total Overburden ('000 bcm)	In-situ Coal ('000 tonnes)	Product Coal ('000 tonnes)	Total Coal Thickness (m)
1	249232	40675	26439	27
2	25831	5195	3377	9
3	242355	36680	23842 ~~2832~~	26
Total	517419	82551	53658	31

Source: Select Mining Services Pty Limited
Note: refer to **Figure 3** for pit location and layout

4.1.3 Coal Quality

Rixs Creek Mine currently produces steaming and coking coal of export quality.

4.2 CHEMICAL CHARACTERISTICS OF OVERBURDEN

Overburden comprises all material above and between the coal seams to be disturbed in the winning of the coal. In the Rixs Creek area overburden consists of sandstones and siltstones with minor amounts of mudstones. The mudstones and siltstones occur typically as thinner beds often associated with the coal seams and the sandstones as beds and lenses which vary in thickness and lateral extent.

Prior to any mining on the site Croft & Associates (1989) assessed the chemical characteristics of the Rixs Creek overburden. Representative samples of rock core were collected from the lease to determine the potential for the generation of toxic or saline leachate from runoff and from water infiltrating backfilled areas. In addition the suitability of the spoils for use as surface dressing in rehabilitation were assessed.

Open cut mining disturbs the existing stratigraphic relationships among the rock strata by inverting large quantities of unweathered spoil and exposing it to a new and stronger weathering environment. As water and air permeate the spoil, reactive minerals are decomposed and soluble salts and suspended clay particles may be transported from the site in surface and groundwaters to degrade water quality in surrounding lands. Chemical conditions which may arise from the weathering of exposed overburden and result in environmental degradation include (SPCC, 1983):

- **Salinity** - waters draining spoil heaps may have unacceptably high concentrations of total soluble salts. Highly saline spoil may have a local effect by inhibiting plant growth, leaving the exposed surface prone to wind and water erosion.
- **Acidity** - acidity results from the oxidation of pyrite (FeS_2) when it is exposed to the weathering environment. Oxidation of the sulphide produces sulphuric acid, which may attack other minerals, releasing environmentally hazardous elements.

- **Sodicity** - sodicity refers to a condition where a relatively high proportion of readily soluble sodium is present in the spoil. As a result, colloidal particles disperse. Spoil containing dispersive clays may be easily eroded, thus further inhibiting revegetation and polluting runoff water with suspended solids.

Cores from three boreholes on the lease were collected and analysed. Chemical analyses were undertaken on saturated extracts from the samples for a wide range of parameters. Tests on all samples included pH, electrical conductivity and soluble cations and on one third of the samples major soluble anions. The results of these tests were used to then calculate exchangeable sodium percentage (ESP) and the ratio of exchangeable calcium to exchangeable magnesium. A summary of these chemical analyses are presented in **Table 4.2** and the full report is reproduced in Study 4, Volume 2 of the original Rixs Creek coal mine EIS (Croft & Associates 1989).

TABLE 4.2
MEAN VALUES OF OVERBURDEN MATERIAL
CHEMICAL ANALYSES, RIXS CREEK

pH	8.0
EC_e (mS/cm)	3.18
Sodium (meq/L)	20.97
Calcium (meq/L)	1.67
Magnesium (meq/L)	4.72
Potassium (meq/L)	0.71
SAR	12.85

Key: SAR = Sodium Absorption Ratio
Source: Croft & Associates 1989

Table 4.2 shows that the spoil is slightly alkaline. Environmental problems associated with either low or high pH values are therefore unlikely to occur. Electrical conductivity is below 4 mS/cm, which is considered to represent a saline threshold. Salinity, as measured by the Sodium Absorption Ratio (SAR), is a characteristic of overburden from the Wittingham Coal Measures. SAR is a measure of a materials sodium hazard. Generally SAR values less than 5 are considered favourable both for maintaining soil structures and avoiding sodium toxicity. SAR values between 5 and 15 are more likely to be unfavourable, while values greater than 15 indicate that a serious sodic problem could result. The mean SAR value at Rixs Creek of 12.85 indicates reasonably sodic conditions.

The investigations into the characteristics of the overburden at Rixs Creek concluded that the mining spoils are generally similar to the existing soils on the site and in particular to be poor in nutrients.

Some spoil is expected to become unstable on exposure, due to dispersion of clays of unfavourable exchangeable calcium to magnesium ratios. Additionally the saline content of the thin mudstone beds could affect plant growth or produce saline leachate. These characteristics are, however, similar to those encountered elsewhere within rocks of the Wittingham Coal Measures and do not represent significant problems. The results of the overburden testing indicate that unusual sodic or acidic problems should not occur.

The principal conclusions made in response to overburden testing on the Rixs Creek site are:

- overburden spoils are unlikely to have significant acid or alkaline potential;
- surface sealing, poor moisture penetration and erosion are the main problems to be expected with spoils remaining exposed at the surface;
- the spoils placed in backfilled areas are unlikely to contribute significant levels of salt to surface or groundwaters.

Since mining operations have commenced on the lease, overburden material is routinely tested to allow selective placement of saline material away from the root zones of plants.

4.3 PROPOSED MINE PLAN

4.3.1 Introduction

A conceptual mine plan has been developed for Rixs Creek. This plan indicates that mining will take place in three pits: Pit 1 - north of the New England Highway, Pit 2 - south of the New England Highway and east of Rixs Creek, and Pit 3 - south of the New England Highway and to the west of Rixs Creek (refer **Figure 3**).

The mine will be equipped and have personnel to move a total volume of mined material of 15 million bank cubic metres per year. This will consist of approximately 2.5 Mt of ROM coal and in excess of 13 Mm^3 of waste material.

The current infrastructure at Rixs Creek Open Cut is capable of processing 2.5 Mt of ROM coal when working hours are increased up to 24 hours a day, 365 days per year. In practice the operation will generally be worked Monday to Friday with some additional make-up provided by weekend overtime.

4.3.2 Constraints to Open Cut Mining

There are two major physical constraints on mining areas. These are:

i. Rixs Creek south of the New England Highway; and

ii. The New England Highway.

TABLE 4.3
CONSTRAINTS TO MINING

Area	In Situ Coal '000T	Waste '000 bcm	Raw Coal Ratio	Best Seam
Rixs Creek South of Highway	494	4543	9.2	Lower Barrett
New England Highway	8468	92258	10.9	Upper Hebden

The coal overlain by these features being beyond the limit of economically viable ratios effectively divided the Lease area into three potential pit areas:

Pit 1 : located to the north of the New England Highway

Pit 2 : located to the south of the New England Highway and to the east of Rixs Creek

Pit 3 : located to the south of the New England Highway and to the west of Rixs Creek

Pit optimisation techniques were then applied to these areas to define limits which would achieve the maximum resource recovery to an average saleable ratio of 9.6:1 on the basis of a washery yield of 65 per cent. This has been used as a basis for the conceptual mine plan.

4.3.3 Equipment and Proposed Mining Method

Rixs Creek has identified two options for open cut equipment selection to achieve the planned amount of waste (overburden, interburden and partings) removal. These are shown in **Table 4.4** which lists typical equipment that will be utilised in the proposed operation.

The dragline option involves the use of a medium sized shovel/truck operation pre-striping in advance of a medium sized dragline. Normal operation would see the shovel worked on two, eight hour shifts per day with the dragline being worked for three eight hour shifts, each working a five day week. If production does not reach expectations, a third shift may be utilised to make up any shortfalls.

Weekend make-up production would be worked by either or both machines depending on any operational difficulties such as wet weather and breakdowns.

The shovel option would be a large shovel/truck operation worked two shifts per day with two small draglines being used on three shifts per day. As with the dragline option, this configuration of shifts will be varied to compensate for any operational difficulties.

MINE SCHEDULING

The conceptual mining plan (**Figure 3**) shows the envisaged sequencing of operations. For scheduling purposes three mining areas have been designated. Neither the New England Highway nor Rixs Creek south of the Highway will be disturbed by mining.

Scheduling has been done by dividing each working level (coal seam or coal seam split level) into 100 m^2 blocks within which all mining operations are carried out before the next block is worked within that level.

The resulting benches create a "staircase" effect along the strip so access is gained to all working levels in each pit. There are always at least two sets of advancing faces to provide maximum flexibility for coal quality blending and equipment working positions.

The mine has been scheduled to operate two pits at all times, with equal amounts of waste material being moved in each pit. Blending requirements may require variation to this with the possibility of working in only one pit or three pits simultaneously.

The probable sequence of working will be Pits 1 and 2 being mined simultaneously for 4 years until Pit 2 is worked out and Pits 1 and 3 will be worked for the remaining life of the mine.

MINING ACTIVITIES

Table 4.4 shows the planned Equipment List. It is indicative of equipment type and size, however, manufactured types may vary from those listed.

The component activities in the mining operations can be summarised as follows:

Site Preparation

Trees and large shrubs will be removed and timber which is of no value will be disposed of. Timber that has economic value (generally hardwoods) will be harvested and used in the construction of fencing and other general purposes.

Drainage controls will be constructed to divert clean runoff around the area to be mined. Contaminated runoff from within the working area will also be collected in drains and directed to dams for settling.

Topsoil Stripping

Scrapers and dozers will strip the topsoil to a depth of 100 mm to 150 mm. Topsoil from the initial boxcut excavations will be used for landscaping of dam walls, road batters and around any existing disturbed areas. Any surplus will be temporarily stockpiled until required for use.

As the mining, backfilling and rehabilitation cycle becomes established, topsoil will be stripped in advance of the mining face and transferred directly to the shaped backfill for spreading. Long term stockpiling will be minimised and when necessary the mounds will be stabilised by seeding.

Weathered Overburden Removal

Scrapers and bulldozers will remove the upper layers of soft and weathered overburden.

Removal of Hard Overburden and Interseam Strata

Rock unsuitable for ripping by bulldozer will be drilled and blasted.

Diesel-electric blast hole rigs will be used to drill large diameter blast holes which will be spaced according to depth and the properties of the underlying rock to be fragmented.

It is expected that ammonia nitrate and fuel oil (ANFO) and a slurry explosive will be used in dry and wet conditions respectively. Using bench heights in the order of 15 m, powder factors of between about 0.5 kg/m^3 and 0.2 kg/m^3 (maximum charge per delay of 480 kg to 290 kg) are expected to be sufficient to ensure adequate fracturing of overburden to ensure

efficient waste removal and satisfy the requirements of the EPA for air blast and ground vibration levels at the nearest residences not owned by the company.

Shovels and/or draglines will be utilised for the removal of the bulk overburden. Generally they will operate in the areas where waste volumes have a thickness greater than 10 m (between 60 and 80 per cent of total waste volume). However, they can be efficiently used down to a bench height of 5 m which equates to 76 per cent to 90 per cent of total waste volume. **Figures 17a** and **17b** show schematics of the intended methods of use of these machines.

The use of shovel and dragline combinations will be such that the shovels will be used in a prestrip operation in the upper working levels with the draglines being used sidecasting in the lower levels. Mine scheduling studies show that the highest pre-strip benches in which the major equipment will be used on are the Pikes Gully Seam for shovel operation and the Lower Middle Liddell Seam for dragline operation, these may vary with economic limits as the pit bottom limits may change.

A combination of large front-end loaders and/or a large excavator (in conjunction with rear dump trucks) plus scrapers will be used to mine the remainder of the waste volume, not moved by shovels or dragline.

Coal Winning

Coal will be ripped and heaped by bulldozer and loaded into coal haulers with a front-end loader. Coal loading will be conducted on three eight hour shifts from Monday to Friday. Shortfalls in production, resulting from breakdowns or wet weather, or the need to fill shipments urgently, will result in supplementary weekend production. Some selective mining of coal will be carried out using a road profiling type machine.

Trial augering of coal from disused highwalls was carried out at Rixs Creek during 1993. The results of this indicated this method of mining (or highwall mining) could be used

economically when conditions were favourable (i.e. seam thickness in excess of 1.5 m is available)

It is intended to use these highwall mining techniques (illustrated in **Figure 17b**) where conditions warrant so as to maximise the recovery of reserves.

Figures 18 to **22** inclusive illustrate the conceptual landform of the mine at the end of Years 1, 8, 15 and 22 years and the final landform respectively.

TABLE 4.4
TYPICAL EQUIPMENT LIST FOR PROPOSED MINE EXPANSION

	Proposed Number
Dragline Option:	
P&H 2800 XPA Shovel	1
Marion 7900 Dragline	1
Shovel Option:	
P&H 5700 Shovel	1
P&H 2355 Dragline	1
Marion 305M Dragline	1
Common Equipment with either of above	
Caterpillar truck 793	6
Caterpillar front-end loader 994	1
Caterpillar bulldozer D11	3
Caterpillar Tiger RB bulldozer	1
Caterpillar 777 water carts (80,000 L)	1
Caterpillar 16G grader	1
BE 45R drill	2
Drillteck D40K drill	1
Caterpillar 992 front-end loader	2
Caterpillar 120 tonne truck	3
Caterpillar 657 scraper	3
Caterpillar road profiler RR250	1
DJB 20,000 litre water carts	2
400T excavator	1

Source: Bloomfield Collieries Pty Limited

4.4 PROPOSED COAL HANDLING AND PREPARATION

The proposed expansion at Rixs Creek will involve the movement of a maximum of 15 Mbcm of material (including both coal and overburden) on an annual basis. The

washing plant and coal handling facilities which are currently utilised at the mine have sufficient capacity to accommodate the projected production and will be used throughout the expansion.

The coal preparation plant has a continuous input capacity of 400 t of ROM coal per hour. At a ratio of 9 bcm of overburden per tonne of product coal, a relative density of in-situ coal of 1.4 and a coal preparation yield of 65 per cent, the plant would operate approximately 5,700 hours per year to process 2.3 Mt of raw coal producing 1.5 Mt of clean product per year.

4.5 PROPOSED REJECT HANDLING AND DISPOSAL

The current method of reject disposal will not be altered.

Coarse rejects will continue to be trucked from the coal preparation plant for disposal within overburden spoil.

Tailings dewatering technology will be continually assessed, however, with the high clay content of the seams to be mined, it is anticipated that tailings ponds will continue to be used for fines disposal. Any future options for tailings disposal will be controlled and assessed through the open cut application process for the site.

4.6 TRANSPORTATION OF PRODUCT COAL

The proposed Rixs Creek expansion may incorporate the construction of a 400 tph overland conveyor to transport product coal from the washery to the rail loading facility. This may replace the internal road truck transportation currently utilised on the site (refer **Section 3.5**). **Figure 23** indicates the proposed route for the conveyor and cross sections through the facility.

All product coal will continue to be transported by rail to the port of Newcastle. Freight Rail have confirmed that they have sufficient capacity to accommodate the additional tonnage being proposed.

4.7 PROPOSED WATER MANAGEMENT

4.7.1 Introduction

The proposed water management scheme at Rixs Creek will continue to follow the principles established during the existing mining operation. Objectives of the proposed water management scheme are:

- Segregation of contaminated and uncontaminated water, thereby minimising the amount of contaminated water.
- Diversion of natural runoff around mining areas to natural drainage lines.
- Settlement of runoff from rehabilitation areas prior to release into main drainage lines until revegetation is sufficiently established to prevent accelerated erosion.
- Consumption of the most contaminated water preferentially for mining purposes such as washery make-up and dust suppression.
- Make provision for "stage discharge" of mine water pending EPA approval.
- Discharge contaminated water in accordance with existing EPA licence conditions on a needs basis.

Proposed mine water management will be in accordance with new proposals being developed by EPA, DWR and industry for staged discharge.

4.7.2 Diversion of Uncontaminated Water Catchments

The diversion of uncontaminated or "clean water" catchments around the mining operations helps to maintain natural flow levels in drainage lines and prevents this water from mixing

with water from mining areas. Mine water can be potentially contaminated by ground water of higher salinity levels, suspended solids from coal fines or colloidal clays from rehabilitation areas. Isolating such areas from clean catchments minimises the quantity of contaminated water generated by operations.

A clean water diversion system has been established above infrastructure and mining areas in the northeast and southeast portions of the mining lease (**Figure 14**). Proposed diversion systems to isolate mining catchments will be implemented in a staged programme to allow for the progress of mining (refer to **Figures 18** to **22**).

Diversionary earthworks constructed above mining areas will intercept runoff flows above mining limits. Water will be diverted at low velocity by graded banks to safe disposal areas and returned to natural drainage lines. Where surface disturbance occurs in constructing such works, grasses will be re-established to maintain "clean runoff".

4.7.3 Contaminated Water Management

Sources of contaminated water include seepage into pits from groundwater, runoff from areas disturbed by mining, water from tailings, runoff from coal stockpiles, hardstand areas and haul roads.

Two levels of treatment for contaminated water are provided. Primary treatment will be implemented close to the source where waters are high in suspended solids or other contaminants. To arrest suspended solids, sediment traps will be provided to detain runoff before entering dirty water dams east of the stockpiles. Sediment traps will be provided along haul roads to catch silt which can be later cleaned out. Existing traps are periodically de-silted to maintain maximum design capacity. This practice will continue.

Runoff from the coal preparation plant, workshop and ROM stockpiles is diverted through oil and grease traps to prevent oil slick development on Dirty Water Dams and possible redistribution to other areas.

Secondary treatment is containment of contaminated water in purpose built storage structures. These are designed to contain a 1 in 10 year, 1 hour storm event. The dams, Dirty Water Dam 1 and Dirty Water Dam 2 are equipped with pump and pipe reticulation systems to allow consumption of the water by the mining operation. These dams will be utilised to contain and redirect for mine usage, all additional contaminated water entering the system.

4.7.4 Rehabilitation Area Runoff

Rehabilitation works consist of reshaping mined areas to 10 degree slopes and re-topsoiling prior to revegetation. Where long slopes are encountered contour banking will be necessary to prevent erosion of the topsoil prior to establishment of a vegetative cover.

During the establishment period, respread topsoil is susceptible to sheet and rill erosion if exposed to high intensity storm events. Resultant runoff is likely to be high in suspended solids. Dispersibility of soils in the Rixs Creek area adds to this problem.

Hence, it will be necessary to contain runoff from rehabilitated areas to allow settlement of solids whilst vegetative cover establishes. This would normally be expected to be a period of about two years, after which runoff can directly flow into natural drainage lines. Sedimentation dams will be constructed to accept runoff from rehabilitation areas throughout the site.

4.7.5 Potable Water

Potable water requirements are currently about 20,000 L per week, amounting to approximately 1 ML per annum. With a maximum anticipated increase of 20 KL per week, the resultant increase in waste water will be minimal with final disposal by on-site aeration and irrigation, assisting the enhancement of landscaped and reclaimed areas.

4.7.6 Water Balance

During the first few years of mining operations, the mine has proved to be a net water user with very limited need to discharge water.

Clean and dirty water dams are in place as indicated in **Figure 14**. Importantly, infrastructure is in place to allow consumption of minewater generated for washery and dust suppression uses thus reducing the need to discharge minewater.

The mining method of progressively backfilling in-pit, significantly reduces the chance of accidental release of minewater during operations. Runoff from active mining and spoil areas reports to the lowest mining bench and collects. It is then transferred to the Dirty Water Dam system by pumping at controlled rates.

Runoff is a complex component of the water balance equation and varies according to such factors as antecedent moisture content, infiltration rate, slope, rainfall intensity, and time of concentration of the catchment. Hydrological studies at the Soil Conservation Service Scone Research Centre analysed 17 years of rainfall and runoff records. Annual runoff co-efficients of approximately 3 per cent were reported by Junor (1977). Rowley (1981) adopted runoff co-efficients of 5 to 10 per cent in the water management model for Drayton Mine where storages have been adequate to ensure nil discharge. Thus a runoff co-efficient of 0.07 has been applied for the calculation of catchment yields.

Development of the additional pit area will generate additional minewater in the form of groundwater inflows and runoff events.

Experience to date indicates groundwater inflow rates may be initially up to 2 L per second or 0.5 ML per day. However, this quickly reduces as exposed strata dewater to a sustained rate of 0.5 L per second or 60 ML per annum. Thus additional groundwater to be stored and reticulated to the dirty water consumption system will be approximately 120 ML per annum.

Runoff from spoil areas and active pits will generate additional dirty water. Pit and mine spoil areas reach a maximum in Year 15 of about 250 ha.

Table 4.5 provides a water balance for the proposed operations under various rainfall conditions. **Table 4.5** indicates that Rixs Creek will experience a surplus of water in wetter than average years, balance supply with demand in average years and will need to draw on water storages during dry years.

Additional water surplus volumes will be stored in staging dams and reticulated to the dirty water consumption circuit. If wetter than average rainfall years results in filling of all available storage, then minewater would be released according to current Clean Waters Act Licence Conditions. Rixs Creek Mine would also assess provisions of a stage release minewater discharge system, if this is adopted at some future time by the coal industry and relevant statutory authorities.

The disused mine access road adjacent to the New England Highway provides a ready site for storage of mine water. This site will provide approximately 150 ML of storage with a rapid discharge capability. This would allow discharge of mine water into Stone Quarry Gully and hence Rixs Creek. The site would provide at least six months of mine water, which would allow controlled release during high flows in the Hunter River in conjunction with EPA/DWR requirements. The site is suitable for storage of mine water as it can be easily isolated from the catchment above and could discharge in a controlled manner into a stable section of Stone Quarry Gully.

4.8 PROPOSED RELOCATION OF MIDDLE FALBROOK ROAD

To facilitate the mining of Pit 1, to the north of the New England Highway, in a westerly direction Middle Falbrook Road will need to be relocated. Rixs Creek propose to relocate the road to the west of the existing alignment. This will affect the section of the road that lies within the lease, between the New England Highway and the Main Northern Rail Line. The proposed relocation route is indicated in **Figure 24.**

TABLE 4.5
WATER BALANCE FOR PROPOSED OPERATIONS

Year	* Supply ML/Year									Evaporation Losses ML/Year							Demand ML/Year						
	Frequency %	Rain-fall	Dam DWD6	Dam CWD6	Dam CWD4	Dam CWD2	Ground-water #	Pit water 0	Total Supply	Ann. Pan Evap.	Ann. Lake Evap.	Dam DWD1	Dam CWD6	Dam CWD4	Dam CWD2	Total Losses	CPP Make-up	In-Pit Haul Rd Dust Suppr'n	Surface Haul Rd Dust Supp'n	Coal Loading Dust Supp.	Coal Stockpile Dust Supp.	Total Demand	Balance
	Catchmnt (ha)									Surface Area (ha)							Demand						
			20	47	223	105				mm	mm	1.9	2.2	4.5	1								
1	10	137	-	-	-	-	120	-	120	1574	1260	24	28	57	13	122	281	48	48	36	11	424	-426
1	50	643	9	21	100	47	120	39	336	1574	1260	24	28	57	13	122	281	48	48	36	11	424	-210
1	90	1561	22	51	243	115	120	95	64	1574	1260	24	28	57	13	122	281	48	48	36	11	424	+100
8	10	137	-	-	-	-	120	-	120	1574	1260	24	28	57	13	122	281	48	48	36	11	424	-426
8	50	643	9	21	100	47	120	114	411	1574	1260	24	28	57	13	122	281	48	48	36	11	424	-135
8	90	1561	22	51	243	115	120	273	821	1574	1260	24	28	57	13	122	281	48	48	36	11	424	+275
15	10	137	-	-	-	-	120	-	120	1574	1260	24	28	57	13	122	281	48	48	36	11	424	-426
15	50	643	9	21	100	47	120	105	402	1574	1260	24	28	57	13	122	281	48	48	36	11	424	-144
15	90	1561	22	51	243	115	120	251	802	1574	1260	24	28	57	13	122	281	48	48	36	11	424	+256
22	10	137	-	-	-	-	120	-	120	1574	1260	24	28	57	13	122	281	48	48	36	11	424	-426
22	50	643	9	21	100	47	120	113	410	1574	1260	24	28	57	13	122	281	48	48	36	11	424	-136
22	90	1561	22	51	243	115	120	270	821	1574	1260	24	28	57	13	122	281	48	48	36	11	424	+275
	Mean								428							122	Mean					424	

* Runoff Calculated Q = 10 CPA where Q is yield in ML, co-efficient runoff = 0.07, P is precipitation and A is area (ha)
Groundwater estimated steady flow rate 60 ML/y each pit (Rixs Creek experience)
0 Zero runoff is anticipated in 10 percentile year of 137 mm rainfall.

As shown in **Figure 24** the existing intersection of Middle Falbrook Road with the New England Highway will be retained. The safety of the road will therefore not be compromised.

Following mining through the affected section of road the original alignment will be reinstated to an equivalent standard that currently exists. This will then facilitate mining further to the west in this pit.

Although Rixs Creek have nominated that Middle Falbrook Road will be mined through, the most likely event will be that the road would be cut by Camberwell Open Cut prior to its intersection by Rixs Creek mine.

4.9 WORKFORCE AND PROPOSED WORKING HOURS

Rixs Creek are seeking to gain approval to operate up to 24 hours per day, 365 days a year.

The existing workforce of 46 will be increased to cater for the proposed expansion. It is anticipated that a total of approximately 92 employees would be required for the dragline option, while 96 would be required for the shovel option. This represents a 45 to 48 per cent increase in employee numbers for the dragline and shovel options respectively.

4.10 PROPOSED REHABILITATION

4.10.1 Introduction

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 a land capability at least equal to that which existed prior to mining.

The rehabilitation process will incorporate direct seeding of pasture grasses and tree species, as well as the use of tube stock in designated areas for screening and beautification.

The majority of the site will be sown with a pasture mixture to stabilise a cover, thus binding the soils and reducing the possibility of dust entrainment and erosion, and extensive tree covered areas will also be planted.

4.10.2 General Rehabilitation Procedures

On the basis of research undertaken by the Department of Mineral Resources, CALM and other authorities as well as operating mines a general sequence of rehabilitation procedures has been established for mines sites. At most mines this involves stages of reshaping, preparation, application of fertilisers, choice of sowing times species selection and site maintenance.

Figure 25a illustrates the manner in which out-of-pit overburden dumps will be formed and stabilised.

Rehabilitation procedures at Rixs Creek will be based upon established practices as well as experience already gained on the site and will be undertaken generally as follows:

- Spoil piles will be reshaped to produce slopes, topography and drainage patterns which blend with the surrounding area. In general slopes will be formed less than 10 degrees.

- Exposed surface rock greater than 500 mm in diameter will be removed or buried prior to the spreading of topsoil. Topsoil stripped in advance of the mining operation will be spread in an even layer at a depth of at least 100 mm. The topdressing material may contain any soil horizon, mixture of horizons or mixture of overburden strata which has been found to be suitable to assist the development and growth of vegetation.

- After topdressing slopes will be deep ripped on the contours, at pre-designed intervals, to assist in soil and spoil combining, as well as forming drainage

catchments and seed entrapments. Following this, the area will be contour cultivated using tynes to bond the new layer with the underlaying spoil. Fertiliser will then be applied at rates as determined in conjunction with CALM, the area will be chisel ploughed on the contour and sown or planted with grass, crop or tree species as approved by CALM. At Rixs Creek, autumn has proven the most successful season for the planting of pasture, with the sowing of tree seed extending into the months of June and July. All of these works will be performed shortly after the spreading of topsoil so as to avoid the loss of activity in the pre-existing microflora, and also to minimise loss of topsoil due to wind and rain action.

- After sowing cattle and other animals will be kept from the treated area. Controlled light grazing will not commence until eighteen months to two years after sowing so as to allow natural seeding of sown pasture.

- Maintenance of rehabilitated areas will be ongoing to ensure complete stabilisation of the area, and to achieve a land capability suitable for grazing. Weed control will be maintained largely by the early detection of infestation and physical removal. Where there is an occurrence of a large weed infestation, chemical control methods may be adopted.

4.11 EXTENSIONS TO ENVIRONMENTAL MONITORING PROGRAMMES

An extensive array of dust gauges (27 in total) have been established within and surrounding the mine lease. The existing dust gauge network is considered adequate to monitor the effect of the proposed mine expansion.

The water monitoring sites established at the mine will continue to be utilised throughout the expansion. The three current sites on Rixs Creek, where the creek enters the lease, the midpoint and where the creek leaves the lease are considered adequate to monitor any impacts arising from the project. Additional sites may be incorporated from time to time to monitor various dams throughout the site depending on prevailing conditions.

4.22

There will be no changes to the blast and noise monitoring practices as described in **Section 3.12.3.**

SECTION 5

IMPACT OF THE PROPOSAL ON THE ENVIRONMENT

5.1 IMPACT ON TOPOGRAPHY, SOILS AND LAND CAPABILITY

5.1.1 Impact on Topography

The extraction of the coal resource by open cut methods will modify the existing topography within the mining area. Detailed features and character of the pre-mining environment will be incorporated into the post-mining landscape as closely as possible. All rehabilitated surfaces will be designed with maximum slopes of 10 degrees.

Figure 22 illustrates the final rehabilitation contours for the site. Elevations for the site could be up to 110 m higher than the pre-mining topography if the proposed large out-of-pit overburden dump is incorporated in the final mine plan. Additionally, swelling of mined overburden and interburden, which has been estimated to have a bulkage rate of approximately 25 per cent will also elevate the post-mining landform.

The high out-of-pit emplacement north of the highway is a consequence of the need to commence Pit 1 with a deep box cut up to 167 m deep to give access to the lower seams. It cannot be approached from the outcrop through the area of high overburden ratio of the ridge along which Middle Falbrook runs. Some 93,000,000 m^3 of overburden must be dumped out of pit in this plan (refer to **Figure 25**).

The final landforms represented in the mine plan are accurate if the total final pit can be mined. It is envisaged that the dumps will be designed to suit actual pit limits through the open cut approval system reflecting the approved mine plans, the equipment available and the current economic conditions.

Figure 25b illustrates sections through the proposed landforms. This figure indicates the progressive development of the dumps including drainage and erosion control measures.

The final landform of the disturbed area will contain three ridgelines (refer **Figure 22**), each running in an approximately north-south direction. Recontouring of the mining area

to the north of the highway will lead to the formation of a single ridge. To the south of the highway spoil will be formed into ridgelines running either side of Rixs Creek.

A total of 123,600,000 m^3 of overburden will be dumped out of pit (refer **Figure 25**). This represents a combined out of pit dumping area of 358 ha. Backfilling in pit will be initiated and continued throughout the life of mine, once a suitable working area has been established.

The final landform incorporates the formation of three voids (refer **Figure 22**). It was considered that three smaller voids would be preferable to one large void. The actual location and size of the final voids will be dependent on the relative rates of mining between the three pits. The most suitable option will be selected for the treatment of these voids at a time approaching cessation of mining.

The issue of the end use of mining voids is one that is presently under review by the Department of Mineral Resources.

A working party has been formed consisting of representatives from the Department of Mineral Resources and Industry. A number of possible uses are being examined and due to the proximity of Rixs Creek Mine to the community of Singleton all possibilities exist. The end uses include sanitary landfill (waste/garbage disposal) passive and/or active waterways and possible tunnel entry points for further mining by underground methods.

The mining method proposed allows for the instigation of a combination of end uses of the voids to achieve maximum benefit to the local community. Consequently after making safe the highwalls the most likely end uses are sanitary landfill and depending on the resultant hydrology and water qualities.

5.1.2 Soils

Whilst open cut mining destroys the original soil profile, rehabilitation measures are employed to compensate and are aimed at creating a profile capable of establishing and sustaining vegetation cover so that pre-mining land capability is either returned or improved.

Topsoil stripping will be undertaken using dozers and scrapers. Where possible topsoil will be directly placed onto reshaped overburden to avoid stockpiling and rehandling and thus minimise soil structural damage. Short-term stockpiles will be placed adjacent to open cut working areas.

Stockpile locations will be determined to minimise rehandling distances to the rehabilitated areas and to ensure that the stockpiles will not require relocation. It is envisaged that when long term topsoil stockpiles are required, where possible, these stockpiles will be formed at depths not exceeding 2 m to maintain biological viability. The stockpiles will be revegetated according to Soil Conservation Service recommendations.

The total area to be disturbed due to mining and associated activities is approximately 725 ha. Therefore, 725,000 m^3 of topsoil is required to topdress the area at a depth of 0.10 m. Some 938,000 m^3 of topsoil will be generated from the proposed open cut stripping area. Allowing for a 10 per cent handling loss, some 844,200 m^3 will be available.

Topdressed areas will be revegetated promptly to minimise erosional losses.

The rehabilitated area at Rixs Creek will have a covering of topsoil sufficient in quality and depth to allow revegetation and stabilisation and the eventual development of pedological differentiation with depth.

Prior to mining commencing on new areas of the lease, more detailed soil surveys will be undertaken to fully evaluate the quantity and quality of topsoil available. These will form part of the open cut application process of the development.

5.1.3 Saline Seepage

The large areas of out-of-pit dumps have the potential to result in saline seepage in the long term. This issue has been addressed below.

The movement of water through spoil heaps is not clearly understood and effects can vary depending on the depth and nature of spoil, type of vegetation cover, surface ponding and surface preparation. All these can affect infiltration propensity. However, there is considerable evidence that even when surface infiltration is encouraged, seepage from the base of spoil heaps is highly unlikely, especially in elevated spoil heaps as high as those proposed in this study.

There have been several studies that have examined salt movement in overburden. Elliott (1983) showed that the distribution of dominant water soluble ions (salts) on coal mine overburden in the Hunter Valley appeared to be related to the occurrence of flood rains. He showed an accumulation of Na, Mg and Cl at 2.5 m to 3 m below the surface exposed for 8 years. He demonstrated the need for substantial rainfall events for salts to move in wetting fronts through the profile to the above depths. At the above depth, moisture would be readily available to tree roots which have been shown to act as biological hydraulic pumps. As such, trees have the capacity to transpire large volumes of water and in turn reduce the potential for downward water/salt movement over time. The establishment of a dense tree cover through using direct seeding techniques would be the most effective technique to achieve maximum spoil water usage and in turn downward salt movement.

There is no evidence to suggest that leaching of salts through spoil depths proposed for this project will occur. The propensity for deep infiltration will be further reduced through the establishment of a vigorous perennial tree cover. The potential for salt leachate will also

depend on the chemical characteristics of spoil material. Section 4.2 indicates that electrical conductivity is below 4 mS/cm, which is considered a saline threshold. The investigations into the characteristics of the overburden at Rixs Creek concluded that the mining spoils in the proposed mining area are generally similar to the existing soils on the site and also similar to those encountered elsewhere within the rocks of the Wittingham Coal Measures and do not pose significant problems. There has been no demonstrated saline leachate effect from these spoil types in the Hunter Valley. Saline seepage from the base of dumps is not expected at any stage.

5.1.4 Land Capability and Land Use

Land Capability

Post mining rural land capability classification will be at least equal to pre-mining capability.

The area of land in the various land capability classes that will be subject to disturbance is shown in **Table 5.1.**

TABLE 5.1
CLASSES OF LAND TO BE DISTURBED

Rural Land Capability Classes	Disturbed Area	
	ha	%
Class IV	366	50.4
Class V	300	41.3
Class VI	60	8.3

The proposed operation will take place on predominantly Class IV and Class V lands. Accordingly, Class IV land will dominate the post-mining landform.

Land Use

Land in the proposed mining area is currently agricultural utilised solely for grazing. Following completion of mining all land will be restored to at least its pre-mining agricultural productive capacity and returned to Classes IV to VI grazing land.

5.2 IMPACT ON HYDROLOGY

5.2.1 Impact on Surface Water

The principal feature of the surface water management system at Rixs Creek Mine will be the continued separation of contaminated and uncontaminated runoff. The system has been designed in accordance with EPA and Soil Conservation Service regulations.

All uncontaminated runoff will be diverted away from disturbed mining areas including overburden dumps, topsoil stockpiles and surface facilities. Diversionary earthworks will re-direct runoff into natural watercourses or into clean water dams which then overflow into natural drainage systems. Proposed clean water diversionary earthworks together with clean water dams are shown in **Figures 18** to **21** and discussed in **Section 4.7**.

Control of contaminated water is at present through Dirty Water Dams 1 and 2 and also through a series of small settling ponds with the capacity to contain all runoff from the design storm event. The dams are of sufficient capacity to retain maximum runoff from a 1 in 10 year storm event of 1 hour duration. These dams accept all runoff from the workshop, coal stockpiles and coal preparation plant areas, groundwater and surface runoff pumped from the pit working area and supplementary water for the coal preparation plant pumped from old underground workings. Runoff from the coal preparation plant and coal stockpile areas is directed through oil and grease traps, baffles and siltation dams prior to entry to the Dirty Water Dams.

Fine washery rejects are transported by pipeline to the tailings dam established in an old open pit, south of the current mining area. Decanted water from the tailings dam is transferred to the Dirty Water Dams for reuse in mining operations.

The data presented in the water balance for the site indicates that the mine currently has more than adequate sediment dam capacity for existing operations. However, strategic selection of the site for future sediment control earthworks is required to cater for the increase in disturbed area as the mine progresses. These control measures will be implemented on the basis of the open cut approval process in consultation with Soil Conservation Service requirements.

As part of the present open cut mining operation, north of the New England Highway, Rixs Creek has been diverted and the area mined through, and further deviations of this drainage line will occur as mining progresses. No deviation of the existing Rixs Creek drainage channel south of the New England Highway will take place. There will be a 20 m buffer established either side of the drainage line to protect the creek environs.

The rehabilitation proposals for the project provide for the reinstatement of a new drainage network on the mined out areas comparable with the drainage pattern and density prior to mining.

The proposed mining operations, both to the south and north of the New England Highway could reduce the stream flow in Rixs Creek as the catchment areas are progressively disturbed. In view of the fact that Rixs Creek is an ephemeral stream and downstream use is limited, the flow reduction due to upper catchment disturbance will be of little significance.

Local flooding downstream of the lease area is caused by backup of the Hunter River on the lower reaches of the Rixs Creek floodplain. The lease area is not affected by flooding and the proposed operations will have little impact on the flooding of the area.

5.2.2 Impact on Groundwater

Presently groundwater inflow into the open cut pit on the northern side of the New England Highway is stable, manageable and can be controlled by being pumped, along with contaminated mine water into the Dirty Water Dams. When the mine develops south of the Highway the groundwater inflows into the new pits is expected to increase steadily as groundwater presently contained within the existing underground workings percolates into the pits.

Previous groundwater investigations suggest that a total yearly make was expected to be in the order of 300 ML. However, this quantity of groundwater make has not been achieved and it is reasonable to expect that the future groundwater inflow will show a shortfall. As the groundwater quality is unfit for discharge from the mine site, two new Dirty Water dams will be constructed in the southern area to contain groundwater makes from this area before it is pumped to the northern infrastructure area for reuse.

The extraction of the coal seams in the area will result in the complete destruction of the bedrock groundwater aquifers. The structureless rock mass formed in the backfilling operations will replace the existing rock strata and aquifers. The loss of the present groundwater resource is not considered a significant impact.

The alluvial flats bordering Rixs Creek are narrow and poorly developed between the mining lease area and the Hunter River floodplain. Farming properties adjoining Rixs Creek use water from the creek on occasions at times of high flow. There are no licensed bores drawing on the alluvial aquifers which are believed to be small in extent and capacity.

The removal of the present bedrock aquifers on the lease area will have little impact on alluvial water because of the low capacity and value of the resource they contain.

5.2.3 Conclusions

The water management procedures presently in place at the mine provide for the total reuse of all minewater under normal rainfall conditions. Demands for water at the mine exceed supply from runoff and pumpout out of the pit, and the balance for the system is provided by the pumpout of water from underground workings on an as need basis.

Water supplies on site comprise runoff from surface facilities, the clean coal stockpile area, the open cut area and groundwater collected in the pit. Water demands comprise dust suppression spraying and losses from washery output in the form of moisture in product coal and coarse reject and the unrecoverable tailings moisture content. Evaporation from the surface of all water storages also constitutes a loss from the system.

Although Rixs Creek Open Cut Mine holds an EPA water discharge licence the mine has had no need to exercise this option since early 1991 at a stage when the water management system was not completed. The effective management of the water control system since that date achieved by the use of underground water supply has ensured nil discharge conditions from that time onwards. The water balance calculations for the site (refer to **Section 4.7.6**) indicate that Rixs Creek will increase storage of water in wetter than average years, balance supply and demand in average years and draw upon storages in dry years.

5.3 IMPACT ON AIR QUALITY

An assessment of air quality impacts associated with the expansion of mining operations at the Rixs Creek Coal Mine has been prepared by Nigel Holmes & Associates. The document is presented in **Appendix 5** and a summary of the assessment is given below. Existing air quality is discussed in **Section 2.8**.

The impact of the proposed project on air quality has been modelled on the basis of dust emissions from the anticipated mine equipment, the proposed mining plan and local

climatic conditions using a computer based dispersion model (DUSTGLC). The model has been used to predict dust deposition rates (in g/m^2/month) and the concentration of total suspended particulate matter (in μg/m^3) at Years 1, 8, 15 and 22 of the proposed operation. These years cover the "worst case" period in terms of dust emissions.

In the past environmental modelling assessments appear to have been overly conservative resulting in estimated "areas of affectation" larger than has been the case in practice. In order to give a more realistic impact assessment the dust model has been calibrated using existing environmental monitoring data collected at both Rixs Creek and the adjoining Camberwell open cut. A full explanation of this calibration work is given in **Appendix 5** and as a result several important modifications have been made to the emission factors used including:

- a reduction in the wind erosion factor for graded and seeded land;
- a reduction in the factor for transport sources;
- a modification to the way in which wind erosion has been handled in the model.

The revision of these emission factors appear to give better agreement between monitored and predicted dust deposition levels and have therefore been adopted for the Rixs Creek assessment.

Dust Impacts

The EPA consider an increase in annual average dust deposition rates of up to 2 g/m^2/month would be acceptable based on the existing dust deposition rate around the project area of 1 to 2 g/m^2/month (annual average) (refer **Section 2.8.2**). For dust concentration the EPA notes the National Health & Medical Research Council (NH&MRC) annual average limit of 90 μg/m3 for TSP. Background annual average concentrations of TSP at the project area are around 50 μg/m3 so an increase in 40 μg/m3 in the TSP could be sustained before the NH&MRC goal is reached.

Figure 26 illustrates the predicted 2 g/m^2/month increase in dust deposition during Years 1, 8, 15 and 22 of the proposed expansion. **Figures 9** to **16** in **Appendix 5** show the predicted increase in annual average dust deposition rates and dust concentrations arising from the project.

The 2 g/m^2/month contours have been used to generate a modelled "area of affectation" based on predicted dust deposition (**Figure 27**). **Figure 27** also shows the current "area of affectation" as determined for the existing operation.

Figures 26 and **27** indicate that the 2 g/m^2/month increase in dust deposition is almost wholly contained within the lease boundary. Small excursions occur to the south and southeast where the contour extends beyond the boundary, however, these excursions become progressively less as the mining operation proceeds.

The modelled "area of affectation" is similar in extent to that of the existing operation, however, it has moved slightly westward, taking it further away from the residential areas of Singleton and Singleton Heights. **Appendix 10** details procedures that will be adopted to manage impacts arising from the development.

5.4 NOISE AND BLASTING IMPACT

5.4.1 Introduction

The effect of the proposed mine expansion on the acoustic environment has been assessed by Caleb Smith Consulting Pty Limited. This report is presented in full in **Appendix 6** and a summary of the findings is given below.

The noise impact assessment is based on measurements of background noise levels and predictions of future acoustic conditions with the proposed expanded mine operating in realistic worst case conditions. An RTA Technologies Environmental Noise Model (ENM) has been utilised to generate potential noise levels surrounding the mine.

5.4.2 Noise Criteria

Appropriate noise quality criteria depend on existing noise levels in an area and the predominant land use category. For this assessment, criteria have been defined for operational and construction phases of the development as well as for rail and road traffic noise. A complete explanation of these criteria in relation to the Rixs Creek expansion is given in **Appendix 6**.

Given the measured background noise levels surrounding the lease, the derived planning levels (taking into account the existing development consent conditions) for rural and residential areas adjacent to Rixs Creek are:

Rural	-	38 dB(A) (Day and Night)
Residential	-	42 dB(A) (Day), 40 dB(A) (Night)

These levels have been adopted in the assessment of the mining operation.

Separate noise limits apply for the construction period. The EPA criterion of 55 L_{10}dB(A) for a medium term project is anticipated to apply for construction of the dragline.

The operation of the mine will result in the concentration of traffic at certain times of the day and intermittent, low flow at other times. The EPA sets environmental goals for the control of road traffic noise based on a recommended Equivalent Continuous Noise Level (Leq,T dB(A)). The use of a maximum L_{10}, 18 hour noise level of 55 dB(A) has been found to meet the EPA requirements for intermittent traffic flow in close proximity to residential dwellings, and this criterion has been adopted for this study.

Similarly, the EPA sets noise criteria for rail traffic. For residences the planning levels are Leq,T 24 hour of 55 dB(A) with a maximum level of 80 dB(A).

5.4.3 Noise Impacts

Figure 26 shows the predicted day and night time noise contour levels based on the criteria adopted for this project. These contours represent the maximum "worst case" noise levels throughout the life of the proposed operation. Noise contours generated for individual years of the operating including Years 1, 8, 15, 22, 29 and 36 are given in **Appendix 6**.

The noise planning criteria limits for the project have been used to generate a modelled "area of affectation" as shown in **Figure 27. Figure 27** also shows the current "area of affectation" determined for the existing operation.

Figures 26 and 27 indicate that impacts arising from noise generated as a result of the expansion are more significant than those of dust. The noise contour extends outside the lease on virtually all sides and has the potential to exceed the appropriate criteria at a number of residences outside the mining lease. On the eastern side of the lease, however, the potential "area of affectation" is similar to that of the current contour and does not encroach upon the residential areas of Singleton Heights.

Appendix 10 details procedures that the Company will adopt to manage any impacts arising as a result of the development.

Construction activities associated with the proposed expansion are not anticipated to result in any adverse noise impacts. Intermittent traffic noise levels have been assessed for the privately owned residences along Rixs Creek Lane (Everleigh and Pitt), the only area likely to experience an increase in road traffic noise as a result of the proposed expansion. The criteria for this residence will be met for both daytime and evening. The limits for night time are, however, currently slightly in exceedence which will further increase with the expansion. This residence is already the subject of an agreement with Bloomfield Collieries under the existing consent and this agreement will be maintained throughout the proposed expansion.

Rail traffic noise will not result in noise levels in excess of the 55 dB(A) criterion.

The assessment of noise impacts has been made assuming neutral atmospheric conditions, however, to satisfy EPA requirements the effects of both prevailing winds and temperature inversions have been considered.

Prevailing winds can increase or reduce received noise levels by up to 9 dB depending on the wind direction and the locations of both the source and the receiver. Predicted noise contours under adverse wind conditions are shown in **Appendix 6** (Figures 28-31).

Temperature inversions occurring during cold, still conditions can result in increased noise levels at considerable distances from the noise source due to bending of sound waves in air layers of different temperatures. The incidence and effects of temperature inversions are not predictable to any degree of accuracy, neither for the site of the focussing effect or the duration of the incidence. Predicted noise contours likely to occur under a very strong temperature inversion are shown in **Appendix 6** (Figures 32 and 33).

5.4.4 Blasting

Blasting Criteria

Blast monitoring is carried out to establish the vibration and overpressure levels that will occur at sensitive properties as a result of production blasting. Blast monitoring data has been provided by Rixs Creek Mine.

The EPA sets criteria of 5 mm/s and 115 dB(Lin) for blast induced vibration and overpressure respectively at residential properties. The EPA vibration limits are related to the repose and comfort of persons and not to the protection of property.

Blasting Impact

From monitored results of previous production blasts, and calculated sealed distance coefficients, the range of ground vibration and blast overpressure results expected at any given distance are predicted. From these results, limiting maximum instantaneous charges (MICs), can be derived to meet the relevant criteria at those distances. The results are presented in graphical and tabular form in **Appendix 6**. The results are interpreted in such a way that a blast having an MIC of 1,172 kg cannot occur any closer than 1,200 m from the nearest non company owned residence, without exceeding the blast overpressure criterion of 115 dBLin. Similarly, a blast of 1,337 kg cannot occur any closer than 1,200 m from the nearest private residence without exceeding the ground vibration criterion of 5 mm/s.

5.5 VISUAL IMPACT

5.5.1 Visual Impact Assessment

A visual impact assessment of the proposed development is given in **Appendix 11**. This assessment provides computer generated images of the development at various stages through the mine life. These images provide a "worst case" interpretation of the visual impact as they do not take into account existing vegetation that currently shields part of the affected area. Photographs taken of existing views have been utilised to further interpret the potential impacts (refer to **Appendix 11**). In addition, cross sections have been generated to illustrate schematically the potential visual impacts of the open cut operations.

The extraction of the coal resource in the lease area by open cut methods will result unavoidably in the modification of the topography of the site. The excavated spoil may elevate the surface by up to 110 m in localised areas of the site, both to the north and south of the New England Highway. These factors and the properties of the fill, as well as the backfilling operations will result in visual disruption of existing views.

As a result of the visual impact assessment (**Appendix 11**) the following points can be made:

- the development will not be visible from the residential areas of Singleton Heights;
- residents along Bridgman Road will receive obscured views of the development and subsequent rehabilitation of the large out-of-pit overburden dump associated with Pit 1.
- residents along Maison Dieu Road will obtain views of the initial development of the mine which will later be shielded by revegetated dumps.
- travellers along the New England Highway have the potential to receive extensive views of the operation at selected locations.

As part of the initial development of the mine, views from Rixs Creek Lane and sections of the New England Highway were shielded by the construction of bunds and tree planting. These works and the existing natural topographic shielding have effectively eliminated all views to the current mine area for travellers along the New England Highway and for private residences in the area. It is intended to maintain the protective 100 m buffer zone for the Highway. The existing landscaped earthworks and tree planting in this zone will be extended on both the northern and southern sides of the highway and will continue to shield views to the expanded mine area whereby possible, thereby, reducing the visual impact of the development.

5.5.2 Ameliorative Measures

Three areas have been identified by Rixs Creek that will benefit from forward tree planting/bunding to reduce visual impacts. These are:

i. The ridgeline between Singleton Heights and the development, from the water storage reservoir running north along the main northern rail line to the lease boundry. This would help screen views from Bridgman Road into the lease.

ii. Bunding and screen planting within 100 m barrier of New England Highway to reinforce the existing tree coverage.

iii. Ridge of initial out-of-pit dump at the extremity of Pit 2.

In summary it can be concluded that the project will result in changes to the topography of the site and the landscape of the subregion in the long term. The disturbance will be significant whist mining is in progress, however, landscaping, tree planting and the construction of protective bunds as ameliorative measures will screen views to the site from roads and residences and mitigate the visual impacts of the development.

5.5.3 Night Lighting

The mining operations have brought about changes in the surrounding area with twilight and night time views altered by bright lights from fixed infrastructure components and moving lights on dump trucks and other mobile mining machinery.

The mine infrastructure area, washery, stockpile and coal loading facilities are all sources of light but are only visible from limited viewpoints on the New England Highway north of the lease area and to a lesser extent from Middle Falbrook Road and Bridgman Road. No residents are currently adversely affected by infrastructure lighting. Travellers using the New England Highway will certainly at times see the moving lights on dump trucks crossing the bridge over the New England Highway and along adjacent haul roads with other mining equipment lights. The impact on travellers is lessened to the extent that the truck movement is low and the Rixs Creek Mine location is close to the town of Singleton and the minimal light sources lead into prominent town lighting.

Lighting Impacts

The mine infrastructure, washery, stockpiles and coal loading facilities will not change and the night lighting impact will remain the same being visible to a low degree from viewpoints from the New England Highway and Middle Falbrook and Bridgman Roads.

As the future mining operations develop to the northwest and southern sector of the lease area, the moving lights of the dump trucks will be visible from the Highway and along the Maison Dieu Road.

Measures will be employed to reduce the impact on the night time visual amenity of the area and include:-

- selective use of haul roads and dumping areas to minimise direct light near main roads;

- the use of dipped headlights on dump trucks where possible and the use of visual barriers such as earth berms to cut off direct views of headlights;

- all floodlights being shielded to the maximum extent possible and positioned to minimise direct lights.

Management of these light control measures will significantly reduce the impact of lighting.

5.6 IMPACT ON FLORA AND FAUNA

The proposed expansion of Rixs Creek open cut will disturb approximately 725 ha of land throughout the life of the operation. Within this area to be disturbed, approximately 170 ha are covered with a mixture of light regenerating or remnant woodland while the remainder comprises cleared farmland.

Appendix 4 details flora and fauna investigations of the Rixs Creek site. No rare or endangered plant or animal species were observed on the site or are considered likely to occur in the area. The impact of the proposal has been assessed in terms of the Endangered Fauna (Interim Protection) Act, 1991 (Appendix 4). This assessment concluded that there will be minimal adverse effects on the survival of protected fauna as a result of the project.

Wherever possible existing stands of remnant/regenerating vegetation will be retained as now is the practice at the mine. Disturbed areas will be revegetated as quickly as possible utilising the techniques described in **Section 4.10**. The rehabilitation strategy will be designed to return the land to an equivalent land capability of the pre-mining environment whilst providing an increased tree cover and diversity.

This emphasis on tree cover may act to encourage fauna species to recolonise the site following mining. The combined retention of vegetation and rehabilitation strategies will assist in ameliorating potential impacts of the project.

Mining will not encroach upon the riparian vegetation adjacent to Rixs Creek to the south of the New England Highway. The creek will be protected by a buffer zone approximately 20 m wide established either side of it. Proposed sedimentation and water quality controls will be implemented as part of the mining operations in order to maintain this environment. It is, therefore, anticipated that there will be no impact on the habitat value of this part of the lease.

5.7 IMPACT ON LAND OWNERSHIP

Land ownership surrounding the Rixs Creek project area can be divided into four main categories. Potential impacts on these various categories are outlined below:

(a) Land Owned by the Company

Land already under Bloomfield ownership will not be affected.

(b) Adjacent Land Owned by Other Mining Companies

Land owned by adjacent mining companies will not be affected.

(c) Privately Owned Land within the Lease and Mining Plan

Land in this category that will be impacted upon as a result of the development is subject to compensation under the Mining Act, 1992.

(d) Land Outside the Mining Plan in Other Ownership

(i) **Rural/Residential:** Land that falls within this category, if shown by monitoring to be affected by noise and dust by prior development consent condition parameters will be subject to purchase under the pending consent conditions, as modified.

(ii) **Land Used for Other Purposes:** Surrounding land used for other purposes including roads, railway, powerline easements, downstream water users and the Rural Lands Protection Board are subject to special conditions as outlined in the original development consent, the lease conditions and other statutory provisions. These will be maintained in the expanded operation (refer to **Appendix 10**).

5.8 TRANSPORTATION IMPACTS

The proposed expansion of Rixs Creek Mine is not anticipated to have a significant impact on the transportation systems in the surrounding area.

Product coal will continue to be railed to the Port of Newcastle. An overland conveyor may be installed on the mine site to transport product coal from the washery to the rail loading facility. This would have the effect of reducing internal truck movements.

Additional traffic generated by the project as a result of increased manning levels will gain access to the site via Rixs Creek Lane. This road has been upgraded since commencement of mining operations on the site and has sufficient capacity to accommodate the proposed increase.

Transportation of Coal Over the New England Highway

An existing overhead bridge across the New England Highway is utilised to transport raw coal from the southern mining area to the site's coal handling and preparation facilities (refer **Section 3.1**). This bridge will continue to be used throughout the expansion of operations at Rixs Creek Mine. The bridge has fine mesh screens erected either side of the structure to prevent spillage of load material onto the highway below. The bridge and it's safeguards are similar in design to structures successfully utilised at Four Mile Creek and Saxonvale mines.

Blasting and the New England Highway

The New England Highway is currently protected from mining by means of a 100 m barrier. No mining can take place within this barrier. Additionally, the Company may not blast within 500 m of the highway while the road is open for traffic. These current operating conditions will be maintained throughout the life of the proposed mine expansion. The Company is not seeking to mine coal under the highway protection barrier and all blasts within the vicinity of the highway will be monitored and limited to levels of vibration adequate to ensure protection of the road.

Based on reserve calculations within the 500 m highway barrier it is anticipated that traffic will be required to be stopped 1,500 times over the life of the mine (based on a 37 year mine life, refer to **Table 5.2** for estimations). This represents one blast within 500 m of the highway every 9 days over the life of the mine.

Delays due to blasting will be in the order of 15 minutes maximum.

The RTA have recently renewed approval to Rixs Creek to instigate intermittent stoppages of traffic on the highway for the period up to 31 March 1996. The stoppage of traffic as a consequence of mining will be undertaken in accordance with all relevant laws, ordinances and regulations. Six personnel at Bloomfield have satisfactorily completed the RTA

TABLE 5.2
NUMBER OF BLASTS WITHIN 500 m NEW ENGLAND HIGHWAY ZONE

Year	Pit 1		Pit 2		Pit 3		Total		
	No. of long blasts	No. of short blasts	No. of long blasts	No. of short blasts	No. of long blasts	No. of short blasts	No. of long basts	No. of short blasts	Total No. of blasts
1	2	2	9	16			11	18	29
2	9	16	6	27			15	43	58
3	12	46	8	12			20	58	78
4	7	46	10	16			17	62	79
5	7	39			4	6	11	45	56
6	6	23			2	5	8	28	36
7	9	23			3	4	12	27	39
8	4	19			2	1	6	20	26
9	3	15			6	23	9	38	47
10	3	11			10	37	13	48	61
11	7	18			10	35	17	53	70
12	5	20			12	39	17	59	76
13	2	2			10	11	12	13	25
14	7	12			8	10	15	22	37
15	7	13			6	13	13	26	39
16	8	13			7	25	15	38	53
17	5	9			4	19	9	28	37
18	5	11			3	2	8	13	21
19	7	12			2	6	9	18	27
20	10	15			4	17	14	32	46
21	11	13			9	29	20	42	62
22	9	22			2	7	11	29	40
23	9	12			1	5	10	17	27
24	9	10			5	9	14	19	33
25	9	11			11	15	20	26	46
26	10	9			3	21	13	30	43
27	8	13			2	10	10	23	33
28	7	10			9	15	16	25	41
29	2	3			8	16	10	19	29
30	6	3			9	7	15	10	25
31	9	3			11	17	20	20	40
32	8	7			1		9	7	16
33	11	11					11	11	22
34	10	8					10	8	18
35	14	13					14	13	27

TABLE 5.2
NUMBER OF BLASTS WITHIN 500 m NEW ENGLAND HIGHWAY ZONE

Year	Pit 1		Pit 2		Pit 3		Total		
	No. of long blasts	No. of short blasts	No. of long blasts	No. of short blasts	No. of long blasts	No. of short blasts	No. of long basts	No. of short blasts	Total No. of blasts
36	13	14					13	14	27
37	16	15					16	15	31
Total	286	542	33	71	164	404	483	1017	1500

Note: Long blasts (300 m)
Short blasts (100 m)
N.B. Table covers entire potential life of mine (37 years)

training course and are able to act as flagmen to direct traffic during traffic stoppages. Whenever mine scheduling requires a blast within the 500 m zone, appropriate signs will be erected in order to warn approaching traffic that blasting will take place and to expect flagmen ahead preparing traffic to stop. Flagmen will be equipped with hand-held radios to ensure direct contact can be maintained with supervisors and blast production personnel.

Relocation of Middle Falbrook Road

Part of the proposed mine expansion involves the relocation of Middle Falbrook Road, if it is still open, to allow mining through this area (refer Section 4.8). The relocated road will be installed prior to mining of the area and the route will be reinstated generally along the original alignment following completion of mining. The existing intersection of Middle Falbrook Road with the New England Highway will be maintained throughout the project as will current standards of road pavement and width. The small amounts of traffic utilising the affected section of road will therefore experience little disturbance as a result of the proposed expansion.

5.9 SOCIAL AND ECONOMIC IMPACT

5.9.1 Construction Workforce

Expansion of the Rixs Creek Mine will necessitate additional equipment. The contracting firms awarded any construction tasks will provide their own workforce which is expected to be drawn primarily from within the Hunter Valley. Such tasks may include the erection of draglines and shovels and the installation of a conveyor to the rail loading facility.

5.9.2 Operational Workforce

To achieve the increased production rate proposed for the mine, an enlarged workforce will be required. It is anticipated that the current workforce of 46 will be increased to 92 employees for the dragline option or 96 employees for the shovel option.

It is anticipated that approximately 50 per cent, or 23 to 25 personnel of the additional workforce required will reside permanently in Singleton, and a proportion of these (say 50 per cent) will already be local residents. Approximately 12 personnel are, therefore, likely to relocate to Singleton from outside the region.

5.9.3 Population

It is expected that the Rixs Creek expansion will increase the Singleton LGA population by a maximum of 48 people. This population increase has been determined by using a base of 12 incoming new workers and assuming each is married with two dependent children.

In practise, a mix of married and single personnel, either with or without children, is likely to be employed. This possible lower number of dependants would have the effect of reducing the total number of people migrating into Singleton to below 48.

Those participating in the infrastructure construction projects are most likely to be drawn from the existing construction industry within the Hunter Valley. Because of the short term nature of the work, construction employees do not tend to relocate their families.

Housing

Due to the relatively small increase in Singleton's population predicted to result from the Rixs Creek expansion, it is anticipated that rental and purchase housing and serviced land will be available to meet incoming resident needs. Singleton Council has ensured that there is sufficient land available appropriately zoned to absorb the steady demand for residential and rural/residential land release.

The Rixs Creek expansion will move the mine's operations in a westerly direction, away from Singleton Heights and adjoining rural small holdings. During the history of operation of the Rixs Creek Mine, Singleton Council has received only one resident's complain (regarding blasting) and it is not anticipated that the westerly expansion will exacerbate this situation.

The amenity (noise, dust, visual impact) of existing and future residential land rural small holding development in the area (as designated in Singleton Council's draft LEP) is not expected to be significantly detrimentally impacted by the mine's expansion.

Education, Health and Community Services

Singleton's health and education services should adequately absorb the small increase in resident population predicted as a result of the Rixs Creek expansion.

There is currently some spare capacity within child care facilities and youth facilities in Singleton, and adequate recreational and sporting facilities within the community to meet the increase in demand which might be expected from the new residents.

Infrastructure Contributions

Singleton Council in its Section 94 Contributions Plan No.1 (July, 1993) has identified community facilities needed in the LGA which should be partly funded from contributions by mine developments. The basis for determining a contribution by a mine development is the number of potential residents the mine generates.

Section 94 Contributions applicable to the proposed expansion, will be negotiated with Singleton Council. Rixs Creek will contribute to community infrastructure which can be reasonably attributed to the requirements of the additional employees and their families generated by the development.

5.9.4 Local, Regional and National Economies

The expansion of the Rixs Creek Mine will have favourable income, employment and industrial output impacts upon the local, regional and national economies.

In addition to direct impacts from mining activities, the multiplier effect on employment, income and output in other sectors of the regional economy must be taken into account. Multipliers are parameters which show the total effect (over a time period) of an initial economic change, e.g. a significant increase in production by a coal mine. Multipliers provide a means of assessing the flow-on effects of a change in economic activity on the regional economy.

An output multiplier indicates the total output effect within the Region (normally measured in value terms) of an initial increase in output sold (e.g. increased coal output from the mine). An income multiplier indicates the total regional effect on income of an initial increase in income (e.g. wages and salaries of the additional personnel employed at the mine). An employment multiplier indicates the additional regional employment effect of an initial increase in employment (e.g. additional jobs within the mine).

The output, income and employment multipliers used for the Rixs Creek expansion are presented in **Table 5.3**.

TABLE 5.3
RIXS CREEK EXPANSION TOTAL IMPACTS ON THE REGIONAL ECONOMY

	Direct Impact	2A Multiplier for Hunter Coal Industry	Flow-on Effect	Total Impact
Output $ million	41	1.56	23	64
Income $ million	4.2	1.66	2.8	7
Employment (persons)	50	1.98	49	99

The three multipliers have been derived by the Centre for Transport Policy Analysis, University of Wollongong (1991), for the coal mining industry in the Hunter Region. The Centre has used the demo-economic 2A multiplier which is the most commonly used form of multiplier and which gives the most accurate picture of economic activity in a region.

The employment multiplier of 1.98 is in the mid range of the figures (1.39 to 2.31) suggested for use in the New South Wales northern coalfields by the Association of Coal Related Councils.

The additional annual output of Rixs Creek Mine, upon reaching full production, has an estimated value of $41M and will impact upon other industries in the supply of goods and services which will be primarily sourced from within the Hunter Region.

As a result of a direct increased annual wages and salary value of $4.2M, regional income is expected to be increased by approximately $7M.

Employment will be created both at the mine and in linkage industries such as transport, maintenance and services. An estimated total of approximately 99 additional jobs are expected to be created within the Hunter Region as a result of the additional 46 to 50 jobs created directly by the mine expansion.

The Rixs Creek Mine expansion will have a significant impact on the revenue accruing at the various levels of the public sector, these being:

Local Government

- Additional rates and charges paid by the Rixs Creek Mine.
- Rates paid by those employees of the Rixs Creek Mine not formerly resident in the Singleton local government area;
- Rates paid by other new residents attracted to the area by the indirect effects of the Rixs Creek Mine expansion on economic activity in the area.

State Government

- Coal royalties paid per tonne of coal sold;
- Rail freight paid to the State Rail Authority for the transport of coal from the rail loading facility to the Port of Newcastle;
- Charges paid to the Maritime Services Board for navigation, pilotage and wharfage services;
- Payroll tax levied on the wages of employees whose jobs have been created, directly and indirectly, by the coal mine expansion;
- Other State taxes and charges.

Federal Government

- Company tax;
- Income tax paid by direct employees of the Rixs Creek Mine;
- Income tax paid by those employees whose jobs have been indirectly created by the coal mine expansion;
- Excise on exports.

5.10 IMPACT ON HERITAGE

5.10.1 Aboriginal Heritage

Aboriginal archaeological surveys and investigations carried out in the Rixs Creek mining lease area are discussed in **Section 2.15** and **Appendix 7**.

The proposed expansion of the Rixs Creek Open Cut has the potential to affect some sites identified in earlier surveys of the lease (Brayshaw, 1981) as well as new sites identified in a recent re-survey of the lease (**Appendix 7**).

Six newly named sites: Granbalong 1 to 6, which incorporate two previously identified sites by Brayshaw, have suffered considerable disturbance and are badly degraded. These sites have been assessed as offering little Aboriginal significance and it has, therefore, been recommended that Consent to Destroy Applications be sought for these sites.

Two additional sites identified in the recent re-survey - Rixs Creek 1 and 2, have been assessed as having high Aboriginal significance. These sites represent the potential for future study. The sites are located towards the southern mining limit of Pit 3 and will not be disturbed by mining until approximately five years after commencement of operations. It has, therefore, been recommended that this area be set aside for future study at an appropriate time. Careful management and future assessment of these sites will ensure that Aboriginal knowledge in the area is maintained.

5.10.2 European Heritage

Items of European heritage significance that occur on the mining lease include the Rixs Creek Coke Ovens and associated works. These items have been classified by the National Trust of Australia and are now protected by a conservation plan, prepared by the mine and submitted to both Singleton Council and the Heritage Council of NSW. This plan ensures

the protection of historic artefacts and conservation of the area. Future mining operations on the Rixs Creek lease will not impinge upon this conservation site.

5.11 ENERGY STATEMENT

The proposed expansion of mining operations at Rixs Creek will result in the net production of energy. The mine will continue to produce coal for export markets. To mine the coal energy will be consumed as petroleum products, electricity and explosives. This energy will be consumed for tasks such as blasting overburden, coal transport, coal processing, conveying and rehabilitation.

The total calculated saleable coal reserves available in the proposed mining area are in the order of 50 Mt (refer **Section 4.1.2**). The specific energy of the saleable will vary between the different seams and splits of seams. A level of 28.9 MJ/kg would, however, represent a reasonable average figure. The total energy output of the project would, therefore, be in the order of 145×10^{10} MJ.

Annual saleable coal production will average 1.5 MTPA, therefore, the annual energy production will be 4.3×10^{10} MJ.

The expanded Rixs Creek operation will continue to utilise the energy efficient mining methods currently employed at the site.

The total energy requirements for the open cut operation will be small when compared to output volumes. The expanded mining operation will improve the overall ratio of output to input energy. These changes will enable larger percentages of overburden to be removed in a more efficient manner.

The ratio of output to input energy has been estimated for various open cut operations in the Hunter Valley (Croft & Associates, 1986, Vol 2, Study 15). Calculations indicate

ratios of up to 81:1 have been achieved. It is anticipated that an energy ratio of at least this magnitude will be achieved at Rixs Creek.

The modern equipment to be used at Rixs Creek is designed for efficiency. The proposed mine plan and mining methods are likewise energy effective. The use of the existing infrastructure including the site's coal preparation plant and transport system will allow the continuation of a viable and efficient operation.

SECTION 6

ALTERNATIVES TO THE DEVELOPMENT

6.1 ALTERNATIVES TO THE DEVELOPMENT PROPOSAL

The Environmental Planning and Assessment Act requires that a proponent consider feasible alternatives to any of the major components of a development and to state reasons for adopting the preferred alternative.

In supporting a development approval to a mining company the Department of Mineral Resources requires the maximum exploitation of coal resources consistent with the demands of safety and protection of the environment. Implicit in the development of the Rixs Creek proposal is the objective of maximising resource recovery consistent with sound mining engineering practice and at the same time ensuring that safeguards were built into the mine planning process to manage the impact and protect the environment.

The various alternatives considered for this project and that are discussed below include:

- mine planning on a pit by pit basis
- underground mining
- alternative open cut mine plan to reduce the depth of workings

6.2 MINE PLANNING ON A PIT BY PIT BASIS

6.2.1 Pit 1 and Pit 2

Without a new development consent the alternative for these pits is for mining operations to cease when the mining area for which development consent is now valid is exhausted.

For Pit 2, the exclusion of Rixs Creek and its barrier from the mined area reduces available reserves. The remaining reserves within this pit now having development consent amount to 0.78 Mt of saleable coal.

Pit 1 with the exclusion of areas including underground mining and within the area for which development consent obtains, has reserves at a limiting ratio of 9 bcm of overburden per tonne of product of 1.945 Mt of saleable coal.

Areas within these pits that already have development consent contain a total of 1.825 Mt of saleable coal. This represents only four years work at the mine at the current production rate.

6.2.2 Pit 3

The proposed Pit 3 lies to the south of the New England Highway and to the west of Rixs Creek. At present mining of this land is restricted due to a surface exception of 20 m and as such the land is subject to a new lease application.

The only alternative for this pit is not to recover the resource. Underground mining techniques in the multiple thin seams available would not be economically viable. Even with the best available underground technology, only a small proportion of the resource could be recovered.

6.2.3 Conclusions

In summary there are only two alternatives available to the Company in relation to the proposed pit configuration:

i. To cease mining when Pits 1 and 2 are exhausted to their present limits.

ii. To seek and develop another mine to provide coal of a similar quality. This is not considered a viable option as there are no sites nearby which could utilise the invested capital.

6.3 UNDERGROUND MINING

Underground mining has also been considered as an alternative. This method of mining is not now considered feasible for the Rixs Creek area, although it has been practised in the past. Underground mining is not now considered economical and results in resource sterilisation.

The conceptual mine plan, as identified in this EIS, covers in situ reserves totalling 82,558,000 tonnes. This tonnage is contained in 38 separate splits ranging from the Hebden Seam in the bottom measures up to the Pikes Gully Seam. In general these coal splits are in very thin sections with only 27.5 per cent of the total reserves being 1.8 m or over in thickness.

Current Australian underground mining practice is limited to seam sections 1.8 m or over. Therefore, if underground mining techniques were employed at Rixs Creek there would be the potential for the sterilisation of approximately 75 per cent of the coal reserve.

Additionally, the majority of the coal available in working sections of greater than 1.8 m is in the Barrett Seams. These seams have a history of difficult mining conditions when previous attempts in the Hunter Valley have been made to mine them using underground techniques.

6.4 ALTERNATIVE OPEN CUT MINE PLAN

The Company has also considered an alternative mine plan which reduces the depth of the proposed mine. This was done after a review of the Draft EIS showing the original conceptual mine plan by the Department of Mineral Resources. The Department has since assessed the alternative mine plan and their views are expressed in a letter received by the Company as shown in **Appendix 1**. The smaller scale of the alternative mine plan represents a significant depletion in reserve recovery with approximately 24 Mt of saleable

coal being lost. This alternative plan is shown in **Figures 28 to 32** which indicate the development of the mine at years 1, 8, 15 and the final completion of the pit.

Features of this alternative mining plan include:

- mine plan layout and scheduling to recover 30 Mt of product coal;
- lower overburden to coal ratios;
- volume of out of pit dumping is reduced;
- there is less necessity to close the New England Highway for blasting;
- the final void of Pit 3 will be self draining;
- the final voids will be smaller.

The pit layout of the alternative mine plan as shown in **Figure 28** is based upon the same three pits in the proposed mine. The mine scheduling has been calculated on the same rate of nominal material movement of 15 bcm per year. The mine has been designed on the basis to minimise slope and dump heights. This was done in order to reduce visual impact, to speed the rate of rehabilitation of out-of-pit dumping and to reduce the effect of noise from dumping operations. In pit dumping was commenced as soon as practicable to minimise both haul distances and the size of the final void.

In the alternative mine plan the final void in Pit 2 would be filled by waste material from Pit 3. In pit 1 the depth of the final void has been substantially reduced compared with the original mine plan. In Pit 3 the final void would be self-draining at a 1 per cent slope to the east.

An assessment of the frequency of blasting within 500 m of the New England Highway has been undertaken for the alternative mine plan. **Table 6.1** shows the results of this analysis. When compared to the original mine plan (refer to **Section 5.8**) it can be seen that 506 blasts will occur over 20 years within this zone requiring traffic to be stopped. The year of

TABLE 6.1
NUMBER OF BLASTS WITHIN 500 M HIGHWAY ZONE
ALTERNATIVE MINE PLAN

Year	Pit 1		Pit 2		Total		
	No. of Long Blasts	No. of Short Blasts	No. of Long Blasts	No. of Short Blasts	No. of Long Blasts	No. of Short Blasts	Total No. of Blasts
1		3	4	7	4	10	14
2	11	13	9	20	20	33	53
3	1		7	26	8	26	34
4			10	15	10	15	25
5				7		7	7
6							
7		30				30	30
8		36				36	36
9		21				21	21
10	2	45			2	45	47
11	1	19			1	19	20
12	4	6			4	6	10
13	4	23			4	23	27
14	6	27			6	27	33
15	7	19			7	19	26
16	6	13			6	13	19
17	9	28			9	28	37
18	4	8			4	8	12
19	7	6			7	6	13
20	22	20			22	20	42
Total	**84**	**317**	**30**	**75**	**114**	**392**	**506**

Source: Select Mining Services
Note - Long Blasts = 300 m
- Short Blasts = 100 m

most stoppages has 53 blasts within the highway zone. The proposed mine plan has 1,500 blasts within the zone over a 37 year period, with the year of most blasts having 79. For the reduced pit there will be, on average, one blast within 500 m of the highway every 14 days over the life of the mine, while for the maximum pit there would be one blast within 500 m of the highway every 9 days over the life of the mine.

The alternative mine plan also considers a deviation of two sections of the New England Highway as shown in **Figure 34.** This deviation would consist of a two lane sealed road. Traffic would be directed along the deviation for the 15 minute period needed to blast rather than being subject to road closure.

The alternative mine plan has also been assessed for noise impacts. A full report on this assessment is given in **Appendix 6**. This report indicates that predicted noise levels for the alternative mine plan are similar in extent to those of the original mine plan (refer to **Figure 35**).

A separate dust assessment has not been undertaken for the alternative mine plan. The modelling undertaken for the maximum pit has been used to represent a worst case for the mine. A comparison between the noise and dust assessments for the project (**Appendices 5 and 6**) indicates that noise has a significantly greater affect on surrounding lands than dust indicating that a separate dust model was not warranted.

The main perceived advantage of the alternative mine plan is in the reduction of visual impact. **Appendix 11** details the anticipated visual impacts arising from both the original and alternative mine plans.

6.5 CONCLUSIONS

The main perceived advantage of the alternative mine plan is in the reduction of visual impact for travellers on the New England Highway and the safety aspects of blasting close

to the highway. The New England Highway traverses some 4 km over the Rixs Creek mining lease and during the mines development overburden dumping and mining operations will be seen from some parts of the highway. Whilst it is not denied that the visual impact will be severe on occasion the ameliorative effect of early reshaping and rehabilitation together with sprays to control dust and tree planting would minimise the visual impacts. Proposed bunds and tree screens can visually isolate the mine from the highway.

The safety aspects of blasting close to the New England Highway are currently addressed by Rixs Creek for their present mining operation. Detailed procedures and risk management assessment has shown that this aspect can be overcome. The closure of the highway for a period of up to 15 minutes every 9 days over the life of the mine for the preferred original mine plan is not considered unreasonable compared with the closure every 14 days for the revised alternative plan.

Of major significance is the loss of approximately 24 Mt of saleable coal with a current value of approximately $840M with subsequent loss of government charges and balance of trade surplus. It is therefore maintained that the opportunity to mine the total resource should be maintained for the enhancement and benefit of future generations.

SECTION 7

REFERENCES

7.0 REFERENCES

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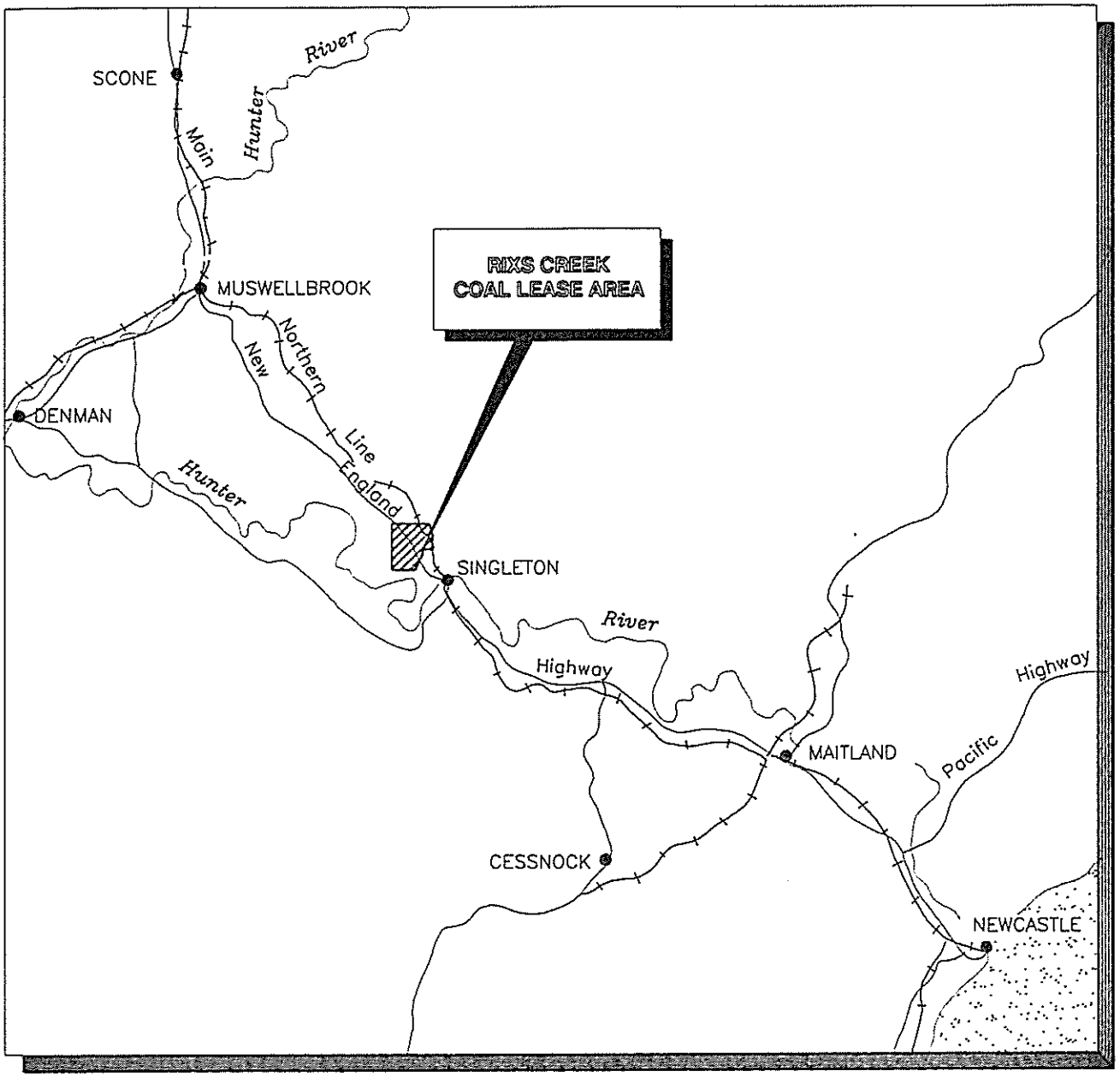
FIGURES



N

0 10 20 30

Kilometres

ENVIROSCIENCES PTY LIMITED

PROJECT No.: F1127

LOCATION PLAN

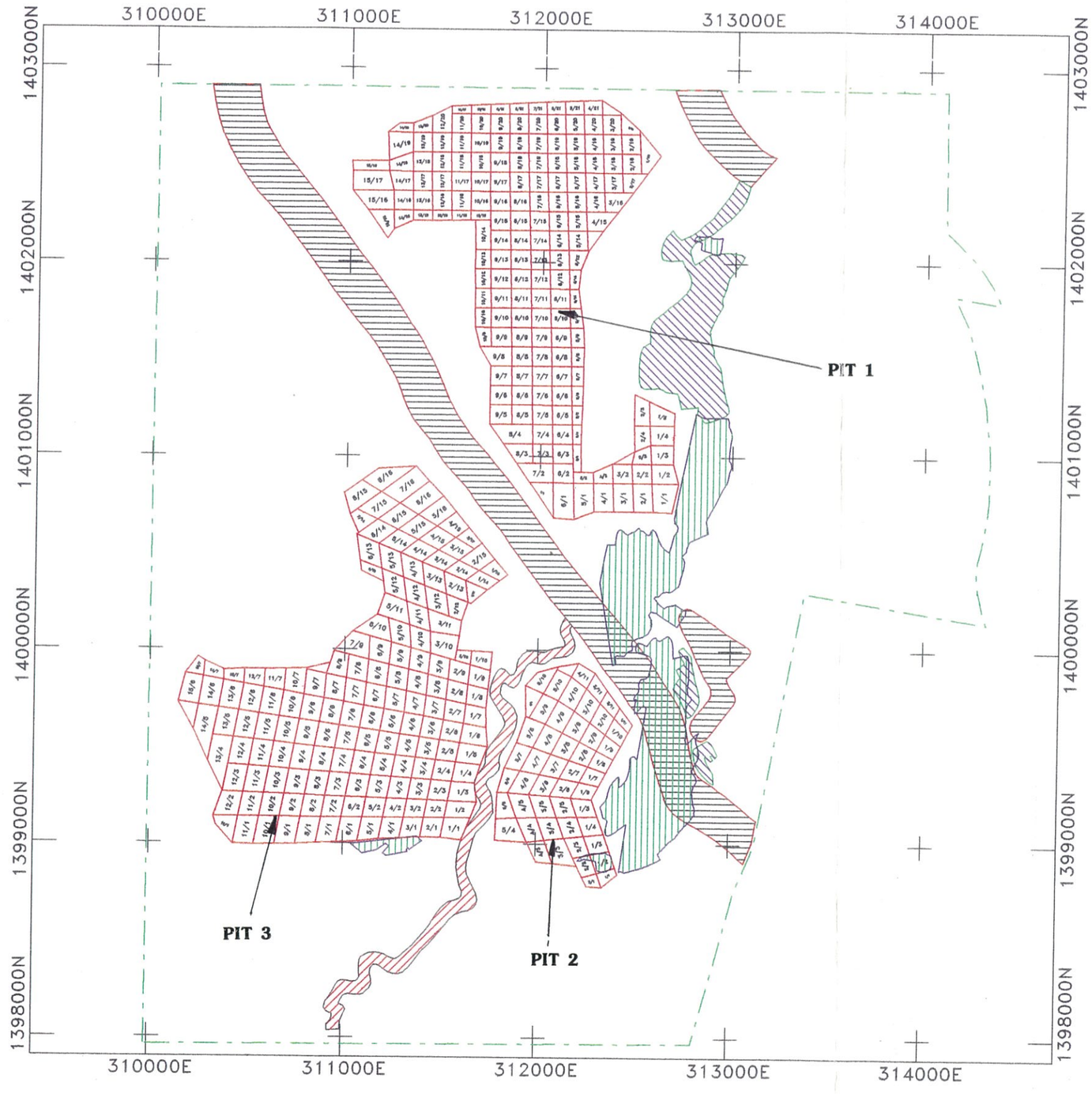
FIG. 1

320 000mE
321 000mE
322 000mE
323 000mE
324 000mE
325 000mE
327 000mE
328 000mE
329 000mE
6 403 000mN
6 402 000mN
6 401 000mN
6 400 000mN
6 399 000mN
6 398 000mN
RIXS CREEK COAL LEASE BOUNDARY
RAIL LOADOUT BIN
WASHED COAL STOCKPILE
BRIDGE
OPEN CUT WORKINGS
WASHING PLANT AND WORKSHOP AREA
ACCESS ROAD
ROAD
FALBROOK
NSW
ENGLAND
MIDDLE
MAIN
NORTHERN
RAILWAY
CREEK
LANE
Gully
RIXS
HIGHWAY
Stonequarry
Creek
BRIDGE
WEIGHBRIDGE
MAISON DIEU ROAD
SINGLETON HEIGHTS
N
LEGEND:
RIXS CREEK COAL LEASE BOUNDARY
COKE OVENS PRESERVATION SITE
SURFACE RIGHTS WITHIN LEASE BOUNDARY
OPEN CUT APPROVAL AREA
0.0 0.5 1.0 1.5
Kilometres
Scale: 1: 25 000
NOTES: GRID USED – AUSTRALIAN MAP GRID
SOURCE – CAMBERWELL 9133-III-S
1 : 25 000 TOPOGRAPHICAL MAP

ENVIROSCIENCES PTY LIMITED
PROJECT No.: F1127

CURRENT MINING AREAS

FIG. 2



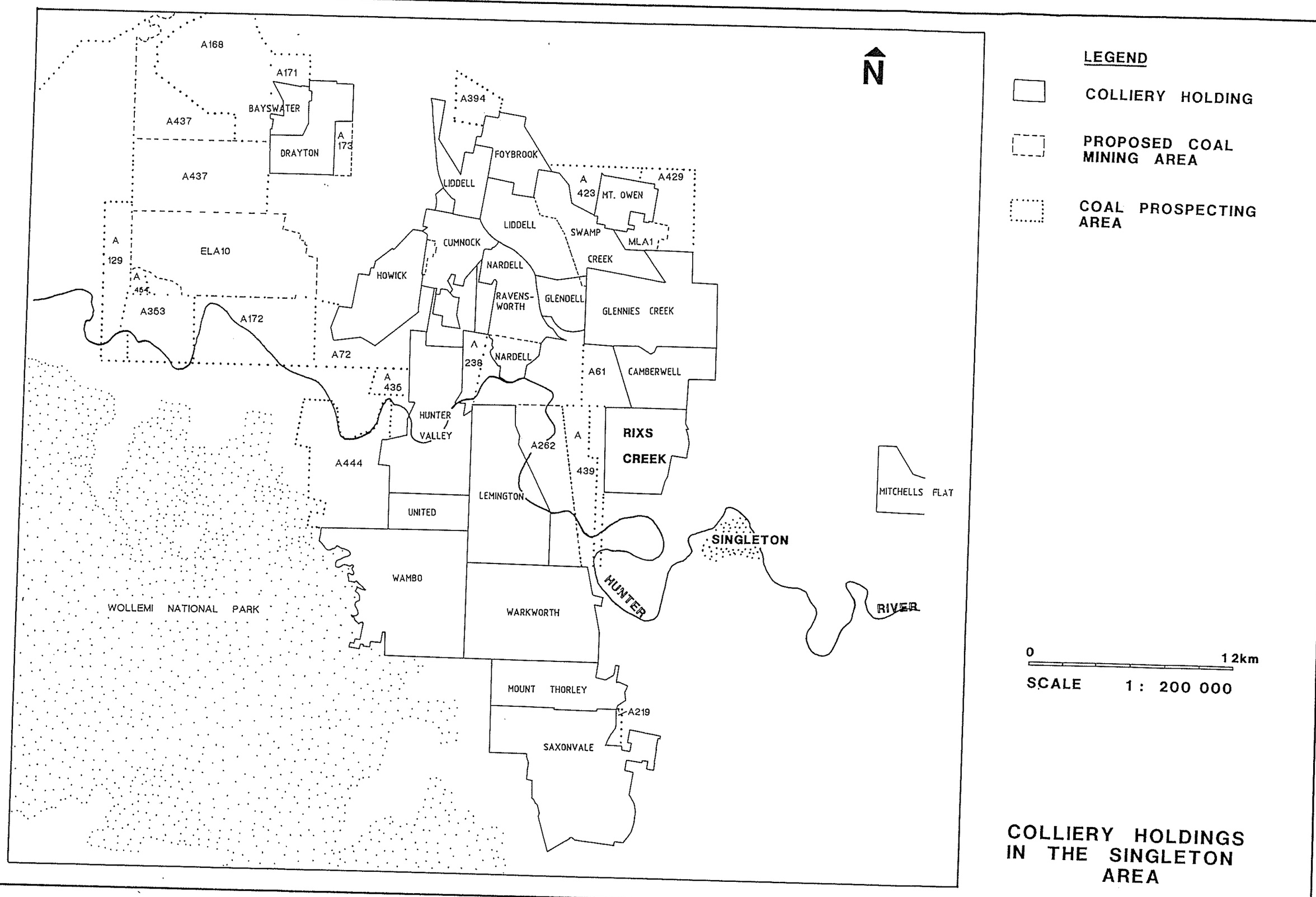
LEGEND

- Underground Workings
- Barriers – Highway, Railway & Coke Ovens
- Open Cut Workings
- Rixs Creek Barrier
- Lease Boundary

ENVIROSCIENCES PTY LIMITED

PROJECT No.: F1127

CONCEPTUAL MINING PLAN *FIG. 3*



COLLIERY HOLDINGS IN THE SINGLETON AREA

ENVIROSCIENCES PTY LIMITED

PROJECT No.: F1127

NEIGHBOURING COAL MINES AND EXPLORATION AREAS

FIG. 4

320 000mE
321 000mE
322 000mE
323 000mE
324 000mE
325 000mE
326 000mE
327 000mE
328 000mE
329 000mE

6 403 000mN
6 402 000mN
6 401 000mN
6 400 000mN
6 399 000mN
6 398 000mN

N

RIXS CREEK COAL LEASE BOUNDARY

NEW ENGLAND HIGHWAY

FALBROOK ROAD

MIDDLE Creek

Stonequarry Creek

MAIN NORTHERN RAILWAY

RIXS CREEK LANE

MAISON DIEU ROAD

Pipers

SINGLETON HEIGHTS

0.0 0.5 1.0 1.5
Kilometres

Scale: 1: 25 000

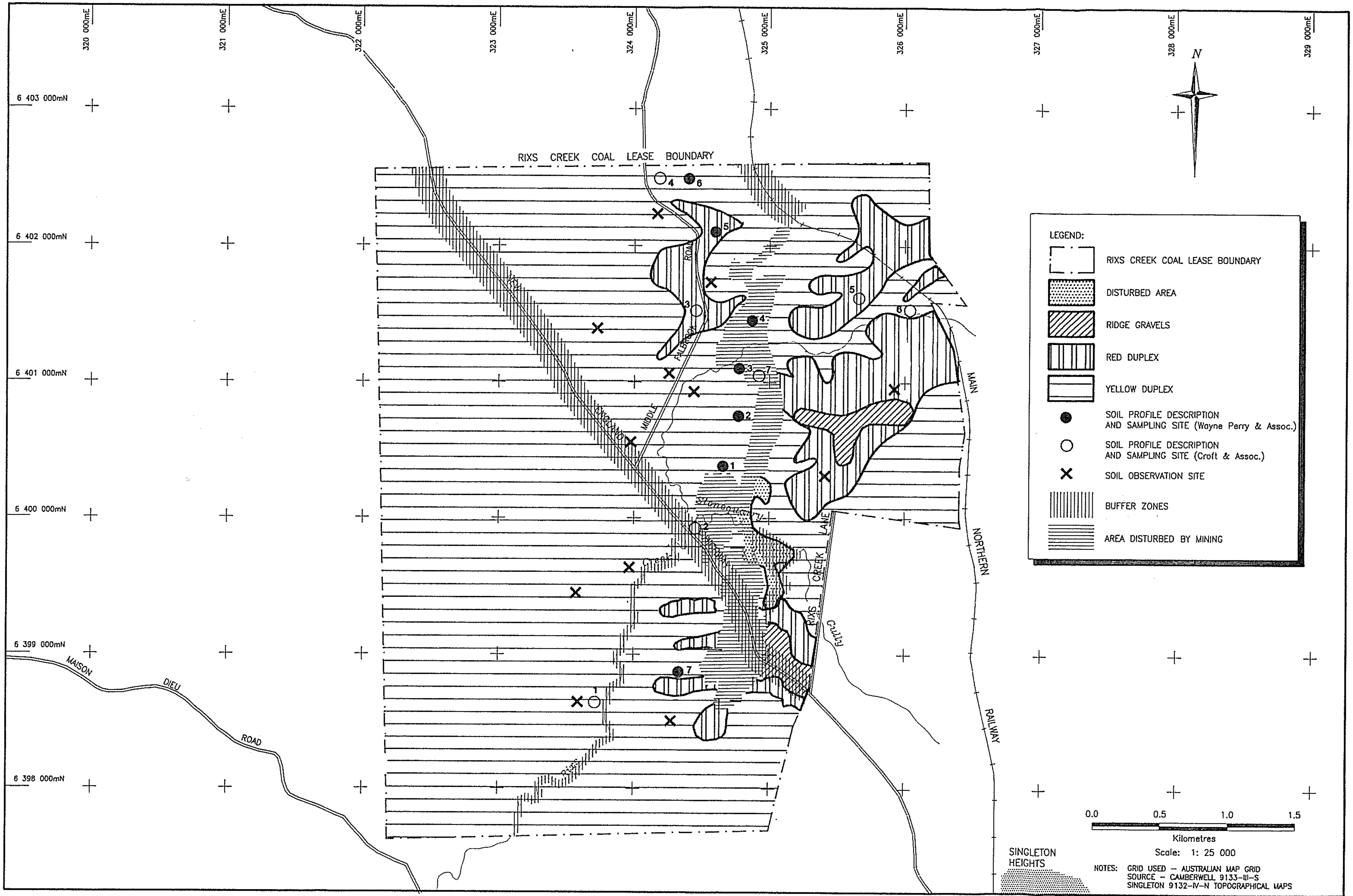
NOTES: GRID USED – AUSTALIAN MAP GRID
SOURCE – CAMBERWELL 9133–III–S,
SINGLETON 9132–IV–N TOPOGRAPHICAL MAPS

ENVIROSCIENCES PTY LIMITED

PROJECT No.: F1127

TOPOGRAPHY

FIG. 5



ENVIROSCIENCES PTY LIMITED

PROJECT No.: F1127

SOILS FIG. 6

320 000mE
321 000mE
322 000mE
323 000mE
324 000mE
325 000mE
326 000mE
327 000mE
328 000mE
329 000mE

6 403 000mN
6 402 000mN
6 401 000mN
6 400 000mN
6 399 000mN
6 398 000mN

N

RIXS CREEK COAL LEASE BOUNDARY

LEGEND:

- RIXS CREEK COAL LEASE BOUNDARY
- NIL STRIP (DISTURBED AREAS &/OR AREAS WITH SHEET EROSION)
- 10cm
- 20cm
- BUFFER ZONES
- AREA DISTURBED BY MINING

MAISON DIEU ROAD
FULBROOK
MIDDLE
GOULDS
ROAD
LANE
CREEK
RIXS
NORTHERN
RAILWAY
MAIN

0.0 0.5 1.0 1.5
Kilometres
Scale: 1: 25 000

SINGLETON HEIGHTS

NOTES: GRID USED – AUSTRALIAN MAP GRID
SOURCE – CAMBERWELL 9133-III-S
SINGLETON 9132-IV-N TOPOGRAPHICAL MAPS

ENVIROSCIENCES PTY LIMITED
PROJECT No.: F1127

SOIL STRIPPING DEPTHS FIG. 7

320 000mE 321 000mE 322 000mE 323 000mE 324 000mE 325 000mE 326 000mE 327 000mE 328 000mE 329 000mE

6 403 000mN
6 402 000mN
6 401 000mN
6 400 000mN
6 399 000mN
6 398 000mN

N

RIXS CREEK COAL LEASE BOUNDARY

LEGEND:

- RIXS CREEK COAL LEASE BOUNDARY
- LAND CAPABILITY CLASS BOUNDARY
- BUFFER ZONES
- AREA DISTURBED BY MINING

MAIN ROAD
FALBROOK
MIDDLE
ENOCHMO
MAIN
NORTHERN RAILWAY
RIXS CREEK LANE
Stonequarry
Creek
Gully
MAISON DIEU ROAD
Rixs
SINGLETON HEIGHTS

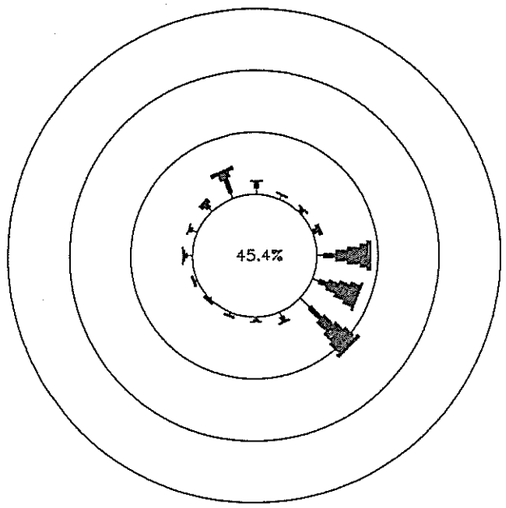
0.0 0.5 1.0 1.5
Kilometres
Scale: 1: 25 000

NOTES: GRID USED – AUSTRALIAN MAP GRID
SOURCE – CAMBERWELL 9133–III–S
SINGLETON 9132–IV–N TOPOGRAPHICAL MAPS

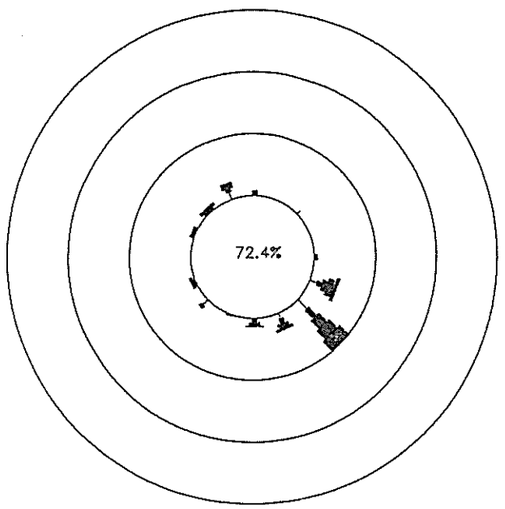
ENVIROSCIENCES PTY LIMITED
PROJECT No.: F1127

LAND CAPABILITY

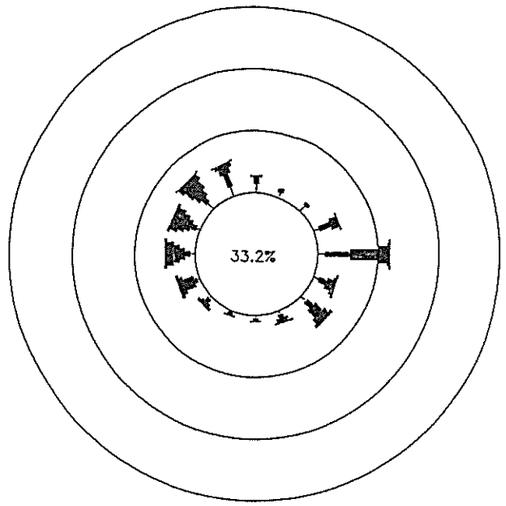
FIG. 8



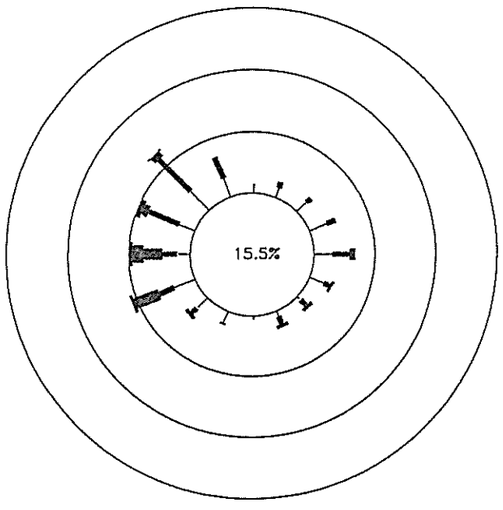
SUMMER 1993



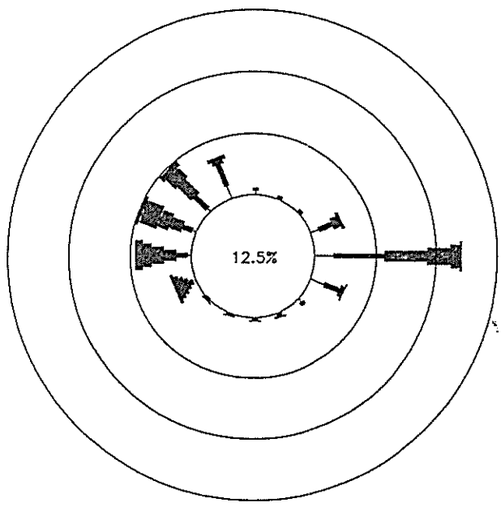
AUTUMN 1993



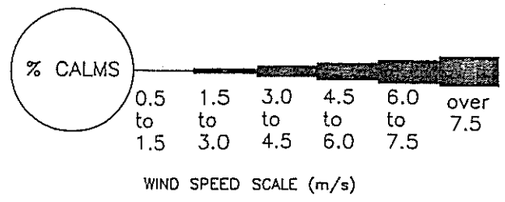
ANNUAL 1993



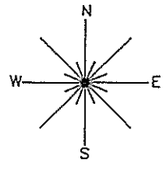
WINTER 1993



SPRING 1993



WIND SPEED SCALE (m/s)



CONCENTRIC CIRCLES REPRESENT
10% FREQUENCY INTERVALS

FREQUENCIES FOR HOURS 0000–2400

ENVIROSCIENCES PTY LIMITED

PROJECT No.: F1127

WIND ROSES

FIG. 9

318 000mE 319 000mE 320 000mE 321 000mE 322 000mE 323 000mE 324 000mE 325 000mE 326 000mE 327 000mE 328 000mE 329 000mE

6 404 000mN
6 403 000mN
6 402 000mN
6 401 000mN
6 400 000mN
6 399 000mN
6 398 000mN
6 397 000mN
6 396 000mN

N

LEGEND:

- RIXS CREEK COAL LEASE BOUNDARY
- DUST SITE
- HIGH VOLUME DUST SAMPLER
- NOISE SITE
- WATER SITE
- PRE-MINING WATER QUALITY MONITORING SITE

RIXS CREEK COAL LEASE BOUNDARY

HUNTER RIVER
Glennies Creek
NEW ENGLAND HIGHWAY
FALBROOK ROAD
MIDDLE ROAD
Rixs Creek
Stonequarry Creek
MAIN NORTHERN RAILWAY
BRIDGMAN ROAD
RIXS CREEK LANE
Rixs Gully
MAISON DIEU ROAD
DIGHTS CROSSING ROAD
SINGLETON HEIGHTS
SINGLETON

0.0 0.5 1.0 1.5
Kilometres
Scale: 1 : 35 000

NOTES: GRID USED – AUSTRALIAN MAP GRID
SOURCE – CAMBERWELL 9133–III–S
SINGLETON 9132–IV–N TOPOGRAPHICAL MAPS

ENVIROSCIENCES PTY LIMITED
PROJECT No.: F1127

MONITORING SITES

FIG. 10

320 000mE
321 000mE
322 000mE
323 000mE
324 000mE
325 000mE
327 000mE
328 000mE
329 000mE
6 403 000mN
6 402 000mN
6 401 000mN
6 400 000mN
6 399 000mN
6 398 000mN
N
RIXS CREEK COAL LEASE BOUNDARY
NEW ENGLAND ROAD
FALBROOK MIDDLE
MAIN
NORTHERN RAILWAY
RIXS CREEK LANE
MAISON DIEU ROAD
DDH6
DH13
DH6
DH1
DH3
DH4
DH5
DH2
B1
B2
B3
B4
90
70
60
Creek
Gully
Gully
Gully
Gully
SINGLETON HEIGHTS

LEGEND:
- RIXS CREEK COAL LEASE BOUNDARY
- GEOLOGICAL STRUCTURE
- TEST BOREHOLE
- ABANDONED COLLIERY
- DIRECTION OF GROUNDWATER DISCHARGE
- POTENTIOMETRIC SURFACE CONTOUR (RLmetres)
- RESISTIVITY TRAVERSE
- BASE OF COAL MEASURES

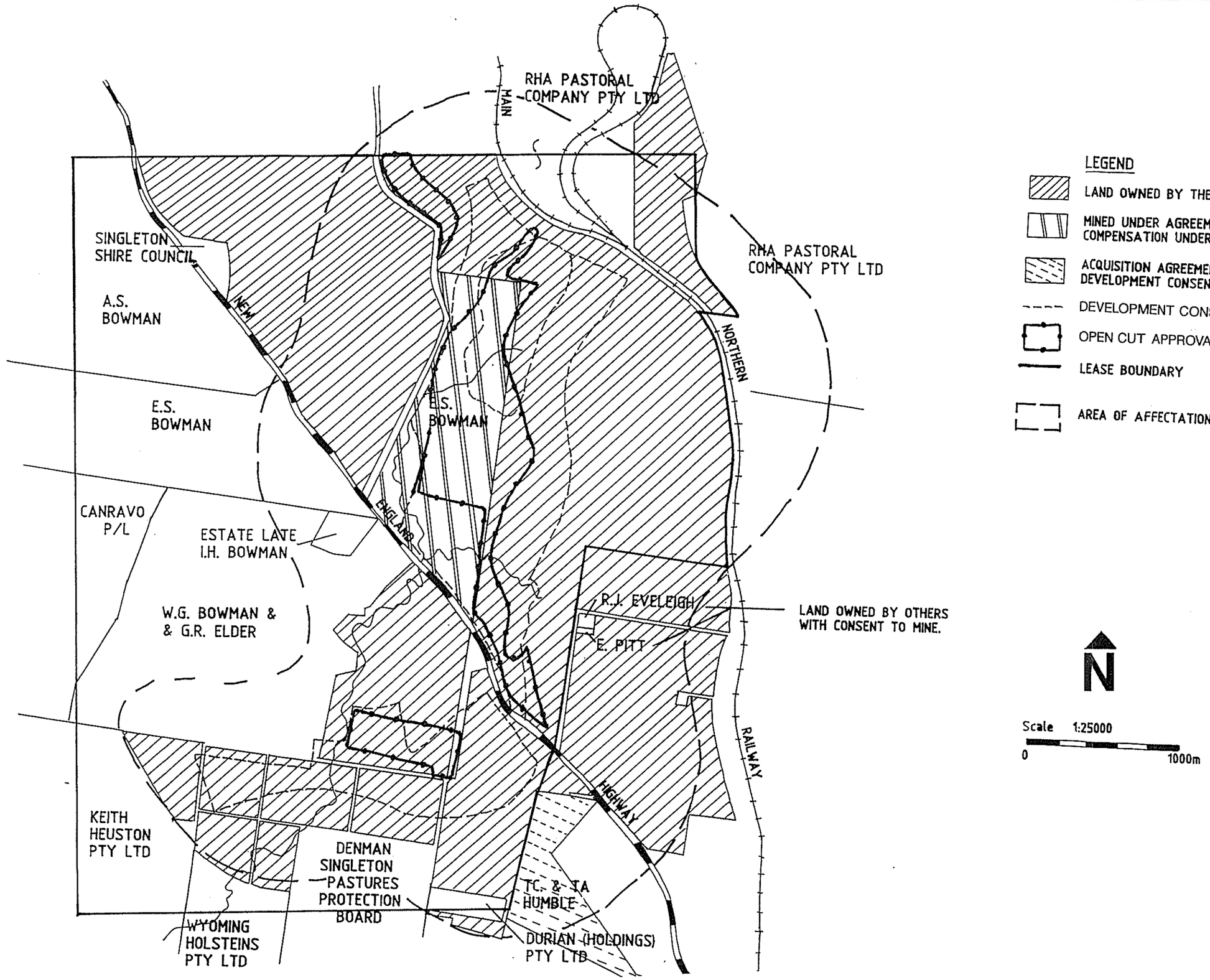
0.0 0.5 1.0 1.5
Kilometres
Scale: 1: 25 000

NOTES: GRID USED – AUSTRALIAN MAP GRID
SOURCE – CAMBERWELL 9133-III-S
SINGLETON 9132-IV-N TOPOGRAPHICAL MAPS

ENVIROSCIENCES PTY LIMITED
PROJECT No.: F1127

GROUNDWATER INVESTIGATIONS

FIG. 11

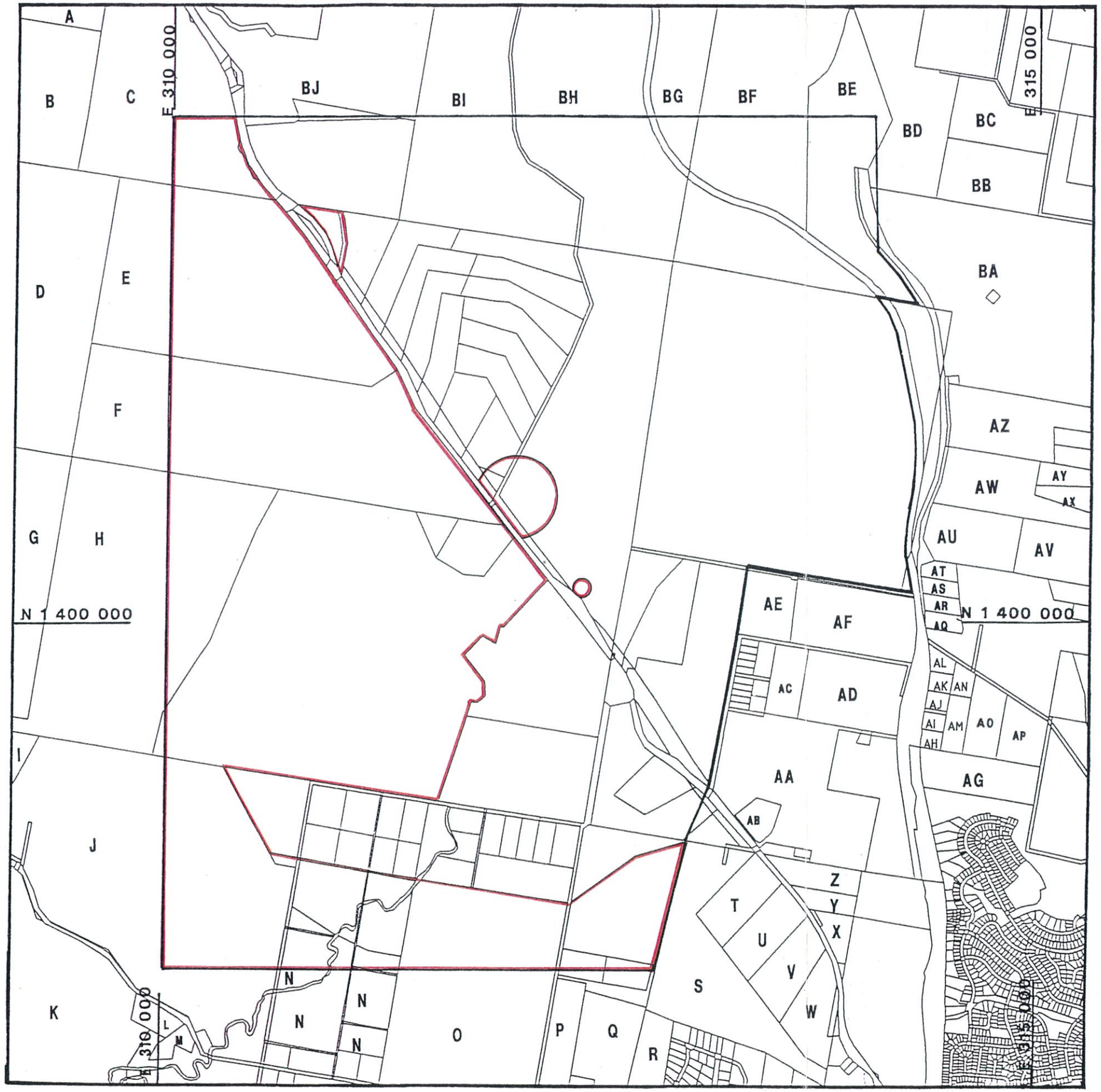


ENVIROSCIENCES PTY LIMITED

PROJECT No.: F1127

LAND STATUS

FIG. 12



LEGEND

COLLIERY BOUNDARY

LEASE APPLICATION AREA

	LOT	D.P.		LOT	D.P.
A	85	752442	B	86	752442
C	PT 2	752442	D	1	121623
E	A	404824	F	12	739911
G	54	252692	H	55	252692
I	1	105912	J	2	804005
K	103	777898	L	1	593741
M	102	777898	N	1004	811415
O	172	727694	P	1	626145
Q	102	740380	R	1	253172
S	7	253172	T	11	253172
U	10	253172	V	9	253172
W	8	253172	X	3	614110
Y	1	614110	Z	11	583232
AA	22	775728	AB	1	736773
AC	21	248630	AD	22	248630
AE	253	752455	AF	235	752455
AG	9	752455	AH	11	752455
AI	12	752455	AJ	13	752455
AK	14	752455	AL	15	752455
AM	16	752455	AN	17	752455
AO	18	752455	AP	23	752455
AQ	52	752455	AR	53	752455
AS	54	752455	AT	55	752455
AV	59	752455	AV	58	752455
AW	3	621647	AX	2	621647
AY	1	621647	AZ	63	752455
BA	22	816458	BB	135	752455
BC	136	752455	BD	240	829334
BE	239	829334	BF	237	829334
BG	237	829334	BH	235	829334
BI	233	829334	BJ	5	264089

SCALE 1 : 25 000

0 1 000m

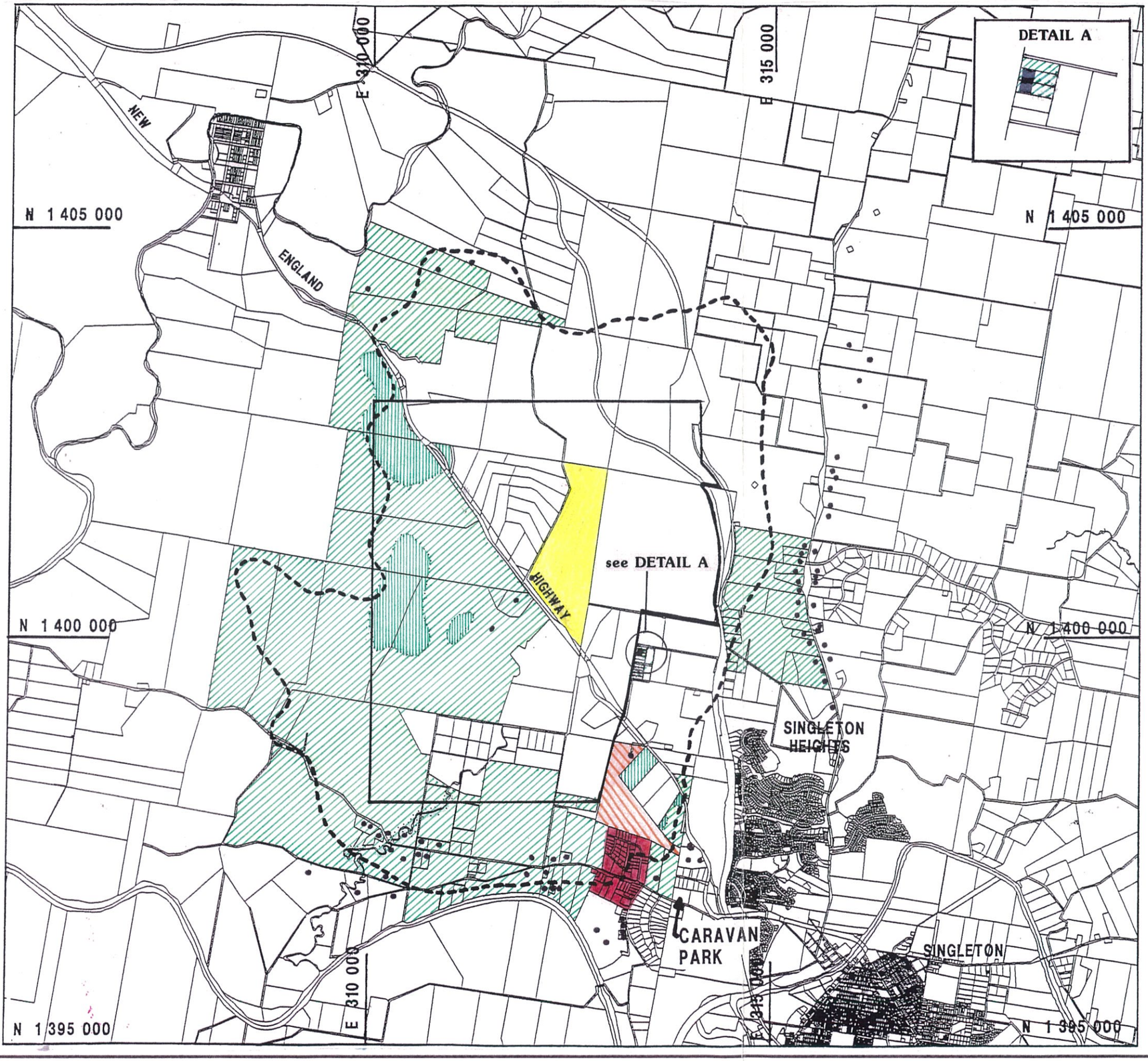
N

ENVIROSCIENCES PTY LIMITED

PROJECT No.: F1127

MINING LEASE APPLICATION
No. 17 SINGLETON (ACT 1992)

FIG. 12a



LEGEND

LAND OWNED BY THE COMPANY, OTHER MINING COMPANIES OR OUTSIDE PREDICTED MAXIMUM AREA OF AFFECTATION.

LAND OWNED BY OTHERS WHERE COMPENSATION ARRANGEMENTS ALREADY EXIST.

LAND OWNED BY OTHERS WHERE AN ACQUISITION AGREEMENT EXISTS.

NON-COMPANY OWNED HOUSES IN THE GENERAL AREA.

NATURAL BUSHLAND.

LIGHT INDUSTRIAL.

GRAZING/ PARTIALLY CLEARED LAND.

PREDICTED MAXIMUM AREA OF AFFECTATION.

LEASE AREA.

N

SCALE 1 : 50 000

0 2 000m

ENVIROSCIENCES PTY LIMITED

PROJECT No.: F1127

LAND USE AND RESIDENCES

FIG. 12b

320 000mE 321 000mE 322 000mE 323 000mE 324 000mE 325 000mE 327 000mE 328 000mE 329 000mE

6 403 000mN
6 402 000mN
6 401 000mN
6 400 000mN
6 399 000mN
6 398 000mN

N

RIXS CREEK COAL LEASE BOUNDARY

NEW ENGLAND HIGHWAY
OLD MIDDLE FALBROOK ROAD
MAIN NORTHERN RAILWAY
Stonequarry Creek
RIXS CREEK LANE
Rixs Creek Gully
MAISON DIEU ROAD

A B C

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

G1 G2 G3 G4 G5 G6
R1 R2

LEGEND:

- RIXS CREEK COAL LEASE BOUNDARY
- (EUROPEAN INVESTIGATION)
- COKE OVENS PRESERVATION SITE
- (ABORIGINAL INVESTIGATION)
- FOOT (SURVEY)
- VEHICLE (SURVEY)
- 3 — OPEN SITES (HAVE HAD CONSENT TO DESTROY)
- 1 — OPEN SITES (RESURVEYED APRIL 1994)
- A,B,C — ISOLATED ARTEFACTS
- G1 — GRANBALONG (RESURVEY SITES 1993) ENVIROSCIENCES
- R1 — RIXS CREEK (RESURVEY SITES 1993) ENVIROSCIENCES

0.0 0.5 1.0 1.5
Kilometres

Scale: 1: 25 000

SINGLETON HEIGHTS

NOTES: GRID USED – AUSTRALIAN MAP GRID
SOURCE – CAMBERWELL 9133–III–S
SINGLETON 9132–IV–N TOPOGRAPHICAL MAPS

ENVIROSCIENCES PTY LIMITED

PROJECT No.: F1127

ABORIGINAL AND EUROPEAN HERITAGE FEATURES

FIG. 13

320 000mE
321 000mE
322 000mE
323 000mE
324 000mE
325 000mE
327 000mE
328 000mE
329 000mE

6 403 000mN
6 402 000mN
6 401 000mN
6 400 000mN
6 399 000mN
6 398 000mN

N

RAIL LOADOUT BIN
WASHED COAL STOCKPILE
RIXS CREEK COAL LEASE BOUNDARY
NEW ENGLAND HIGHWAY
ROAD
MIDDLE
FALBROOK
TAILINGS PIPELINE
OPEN CUT WORKINGS
WASHING PLANT AND WORKSHOP AREA
ACCESS ROAD
MAIN
Stonequarry Creek
DISUSED TAILINGS DAM
RIXS CREEK LANE
Gully
NORTHERN RAILWAY
WEIGHBRIDGE
MAISON DIEU ROAD
Rixs
SINGLETON HEIGHTS

LEGEND:
- RIXS CREEK COAL LEASE BOUNDARY
- COKE OVENS PRESERVATION SITE
- CLEAN WATER DAM
- DIRTY WATER DAM
- CLEAN WATER DIVERSION DRAIN
- DIRTY WATER DIVERSION DRAIN
- PIPELINE
- EMPLACEMENT AREA 2

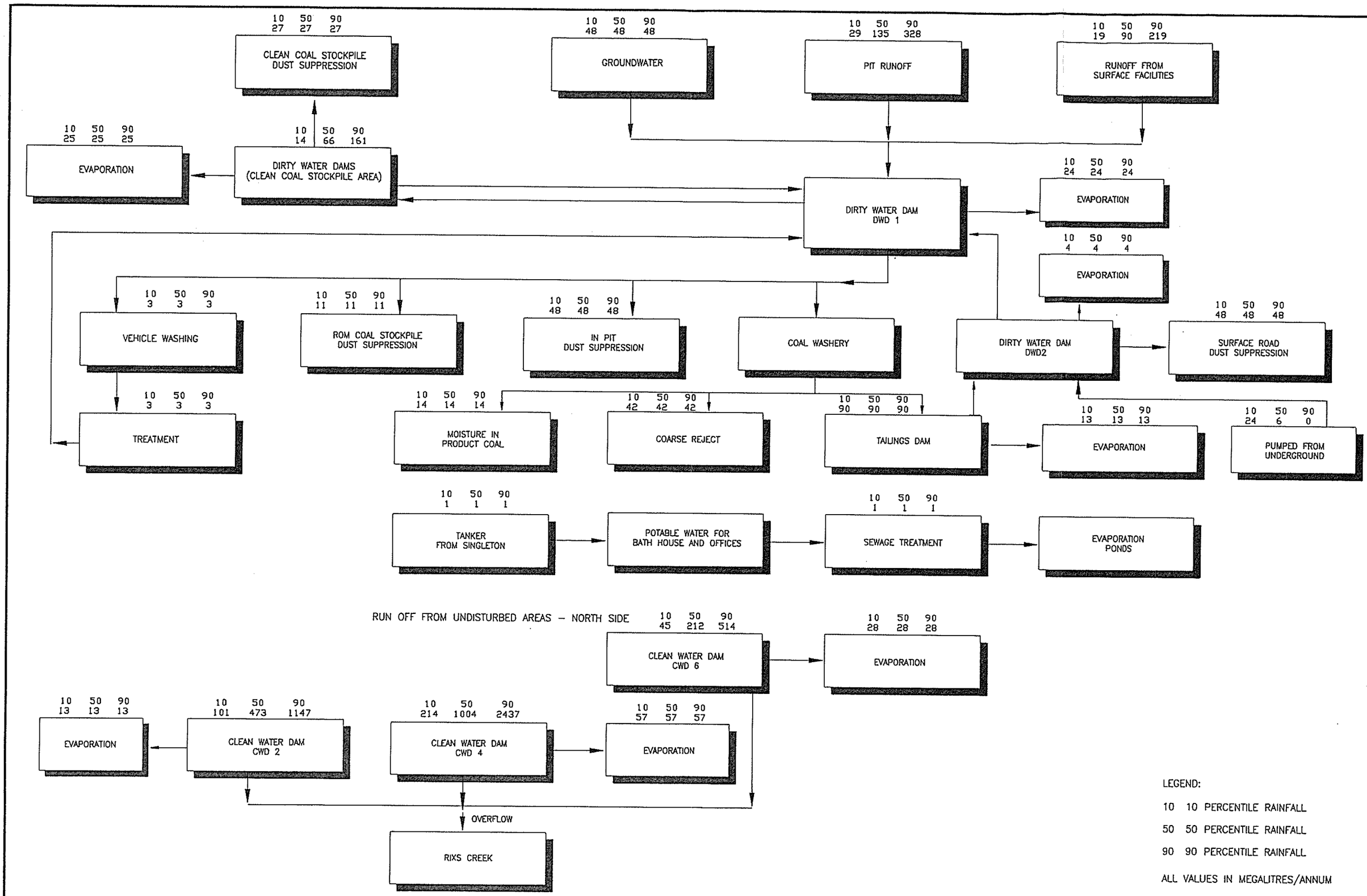
0.0 0.5 1.0 1.5
Kilometres
Scale: 1: 25 000

NOTES: GRID USED – AUSTRALIAN MAP GRID
SOURCE – CAMBERWELL 9133–III–S
1 : 25 000 TOPOGRAPHICAL MAP

ENVIROSCIENCES PTY LIMITED
PROJECT No.: F1127

EXISTING WATER MANAGEMENT STRUCTURES

FIG. 14

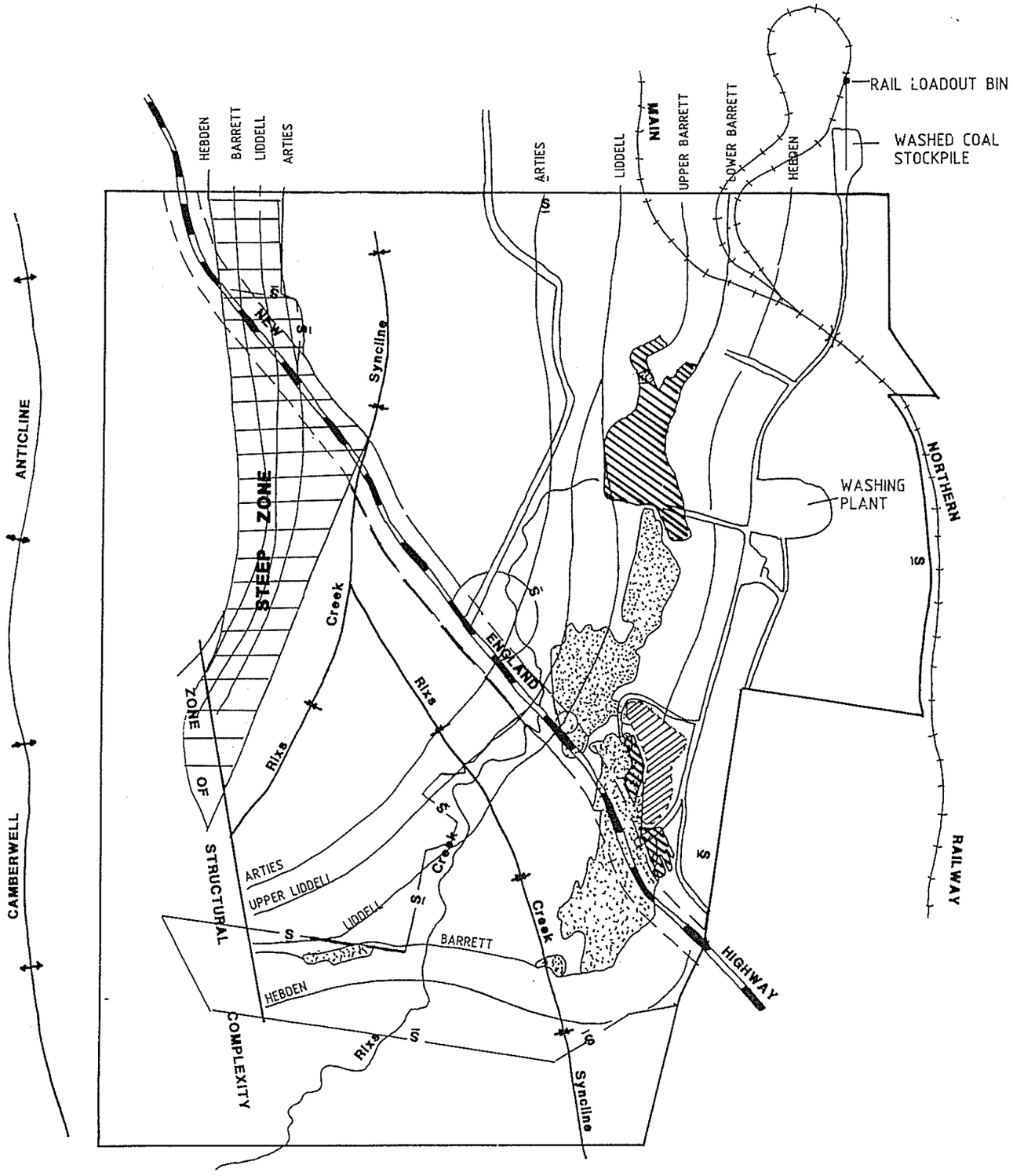


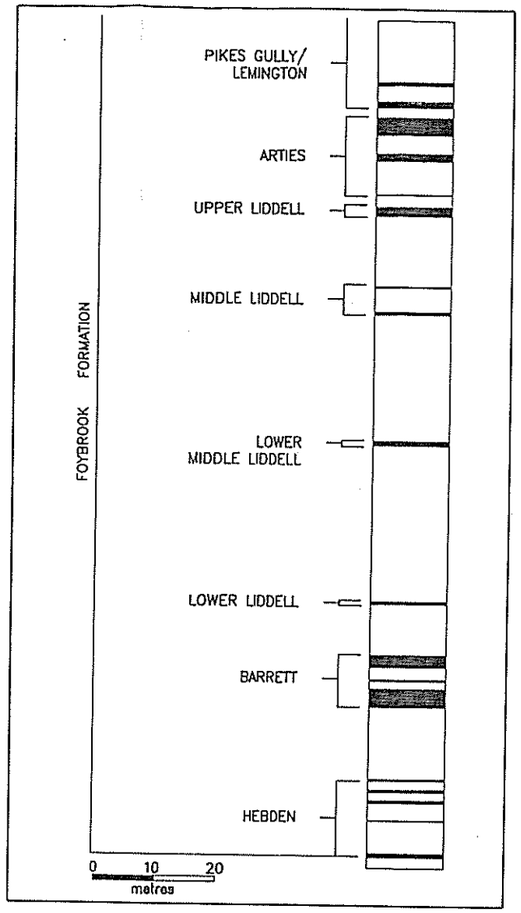
ENVIROSCIENCES PTY LIMITED

PROJECT No.: F1127

EXISTING WATER BALANCE

FIG. 15





LEGEND

- Lease Boundary
- —s— Surface Rights
- Underground Workings
- Highway Barrier 200m Wide
- Coke Oven Preservation Site
- Open Cut Workings

Scale 1:25000

0 1000m

N

ENVIROSCIENCES PTY LIMITED

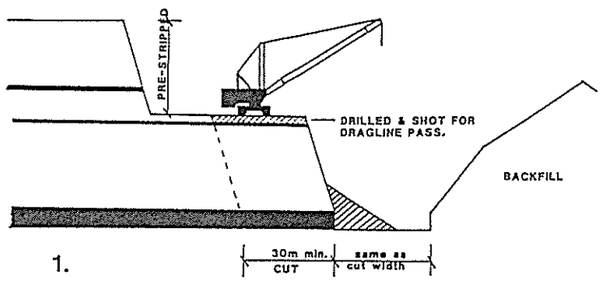
PROJECT No.: F1127

SITE GEOLOGY AND MINING

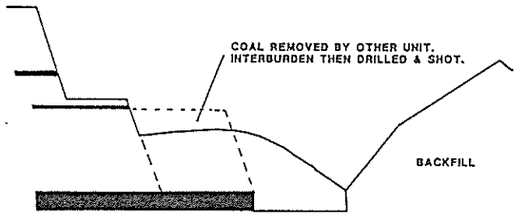
FIG. 16

DRAGLINE

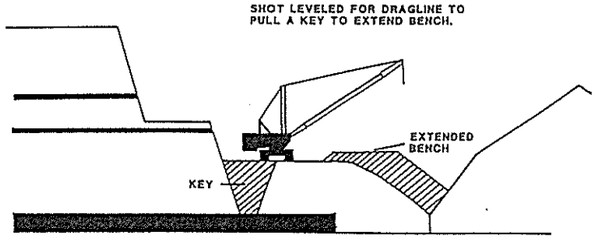
PRE-STRIPPED BY OTHER MINING UNIT.
GOVERNED BY DRAGLINE CONFIGURATION



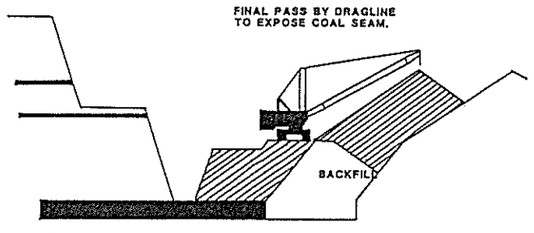
1.



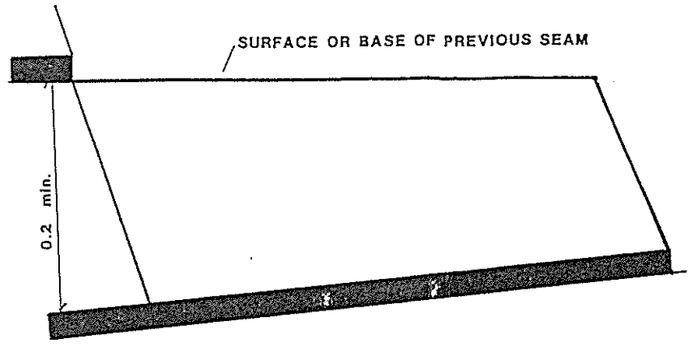
2.

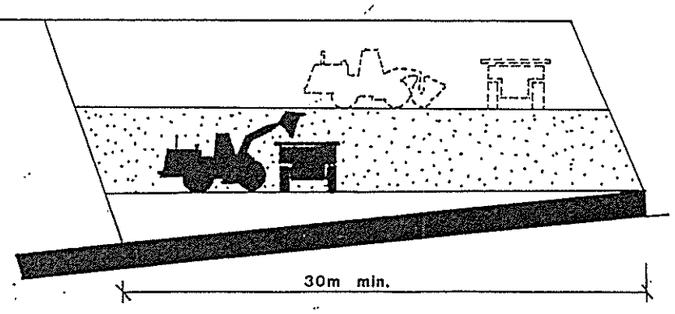


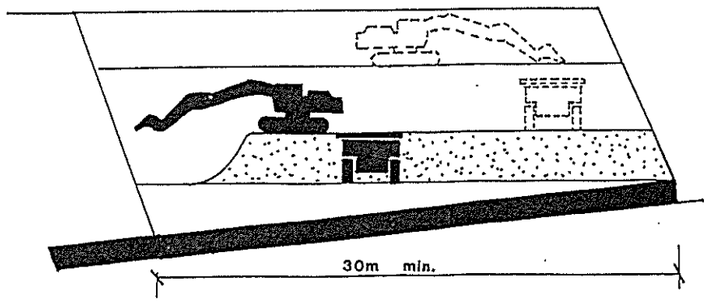
3.

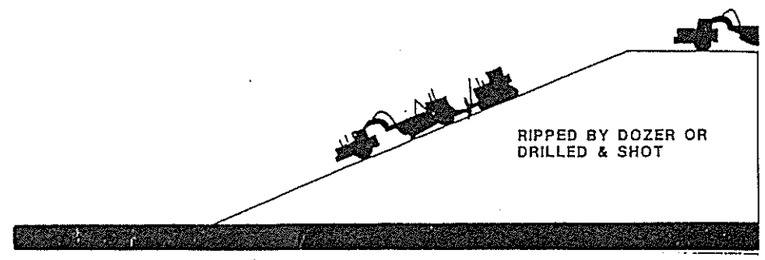


4.

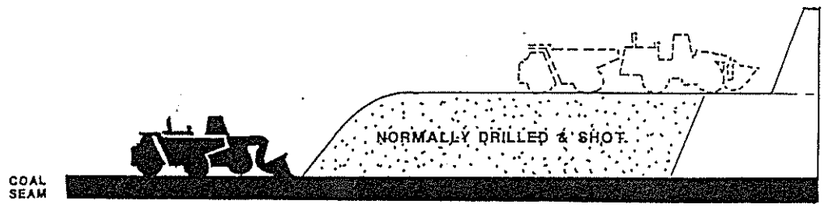




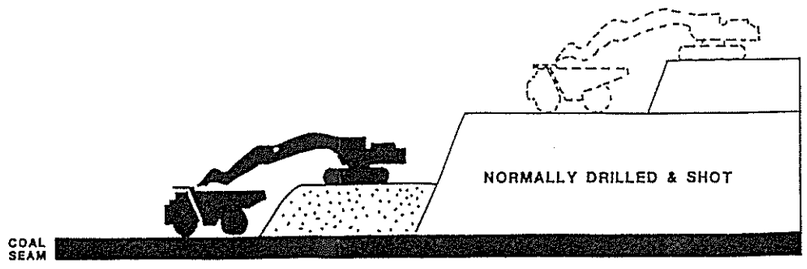




SCRAPER UNIT



LOADER UNIT



EXCAVATOR UNIT

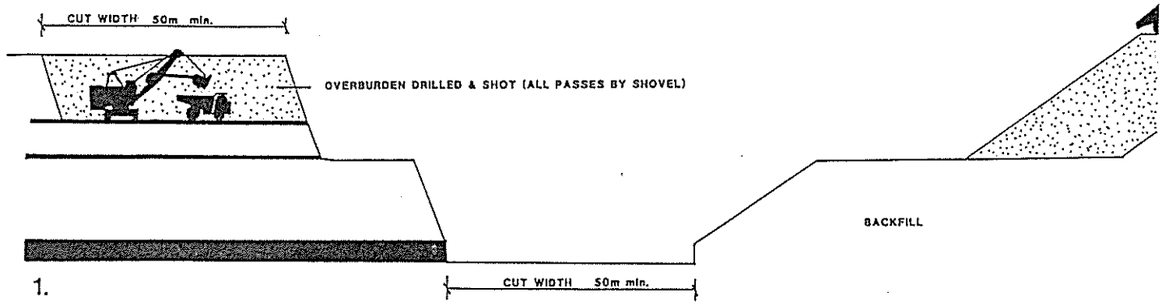
MAXIUM DIG DEPTH GOVERNED BY MACHINES CONFIGURATION

ENVIROSCIENCES PTY LIMITED
PROJECT No.: F1127

SCHEMATICS OF MINING OPERATIONS

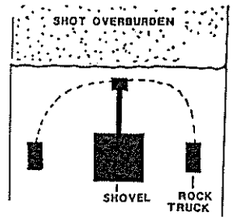
FIG. 17a

SHOVEL UNIT



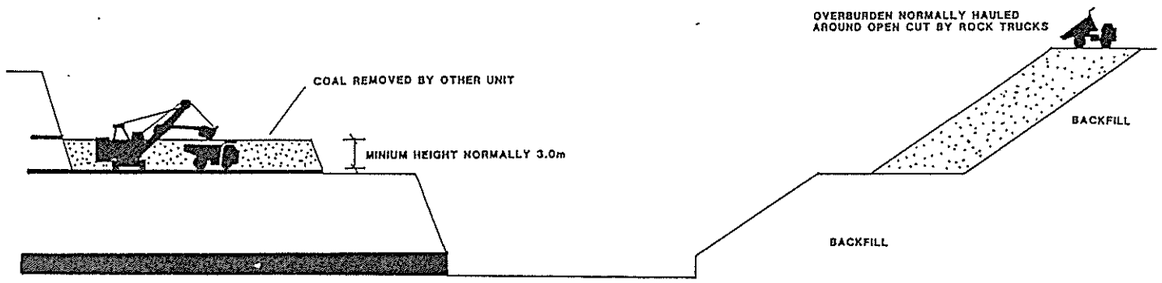
1.

SHOVEL UNIT

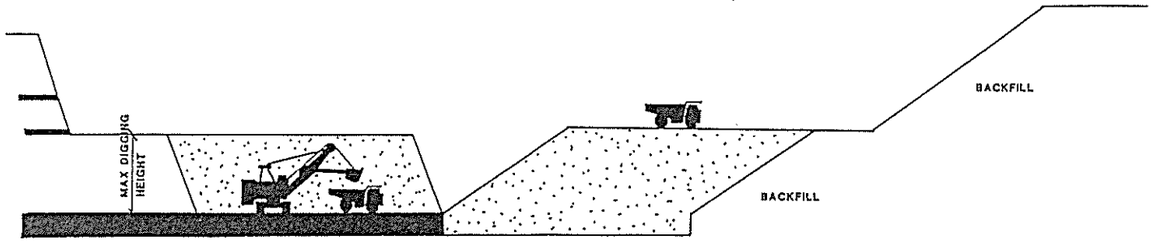


PLAN

WIDTH OF CUT GOVERNED BY
1. SIZE OF SHOVEL & TRUCKS
2. LOADING TRUCKS ON ONE OR BOTH SIDES.



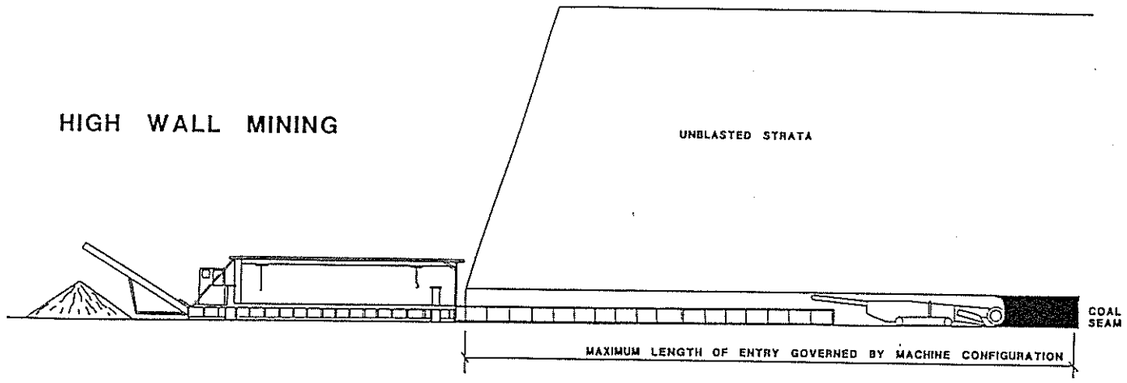
2.



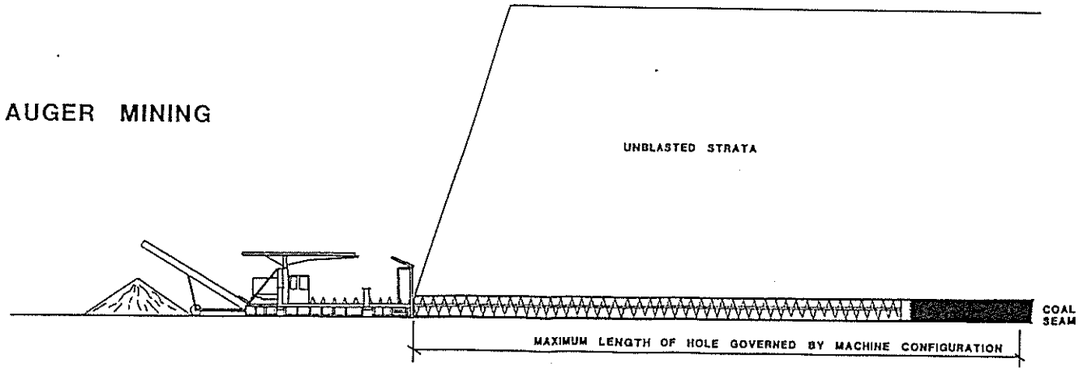
3.

NB. MAXIUM DIGGING HEIGHT GOVERNED BY SHOVEL CONFIGURATION

HIGH WALL MINING



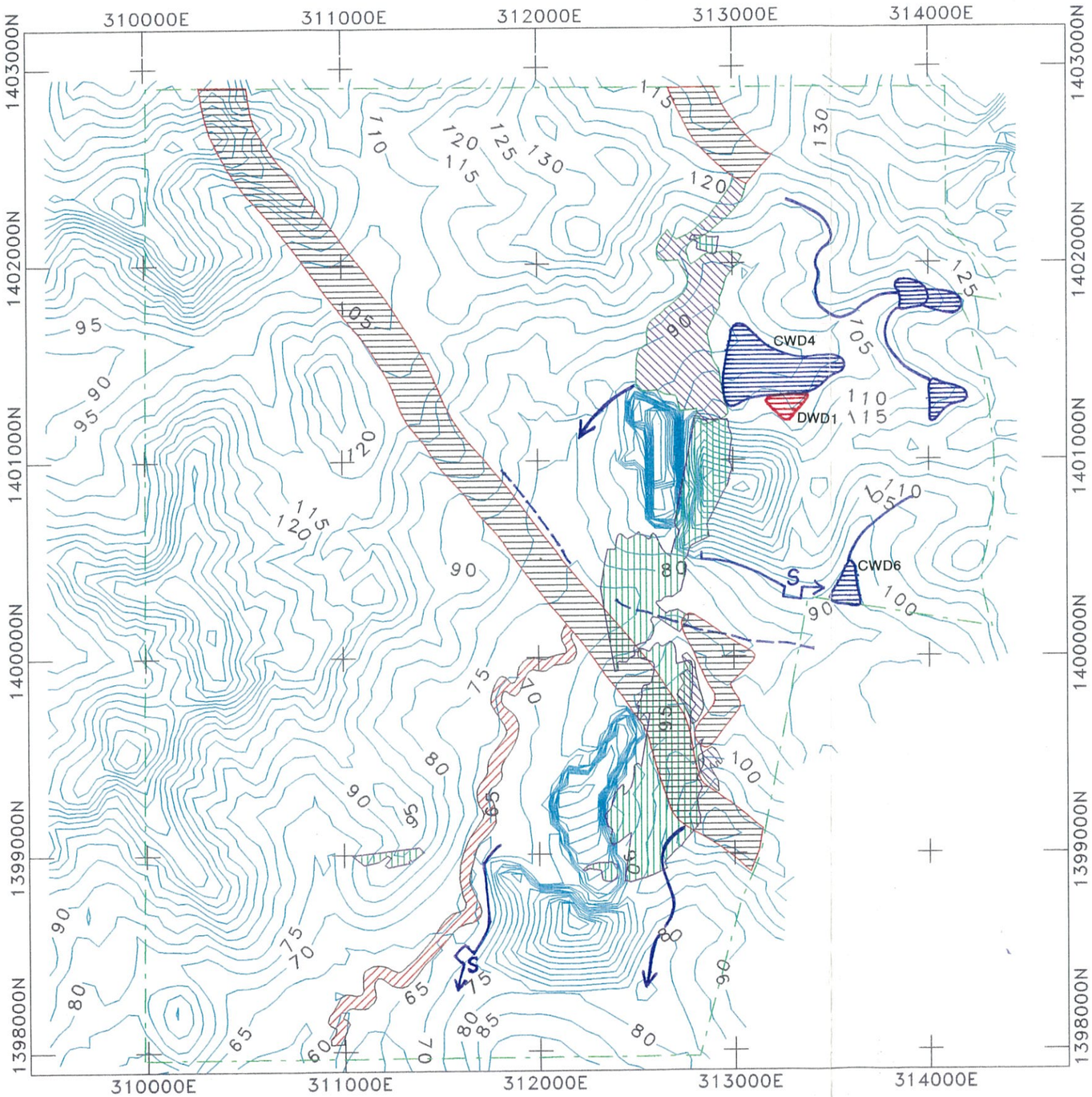
AUGER MINING



ENVIROSCIENCES PTY LIMITED
PROJECT No.: F1127

SCHEMATICS OF MINING OPERATIONS

FIG. 17b



LEGEND:

- Underground Workings
- Barriers – Highway, Railway & Coke Over
- Open Cut Workings
- Rixs Creek Barrier
- Lease Boundary

CONCEPTUAL WATER MANAGEMENT STRUCTURES

- Clean Water Dam
- Dirty Water Dam
- Clean Water Drainage Line
- Diversion Bank
- Sediment Control System

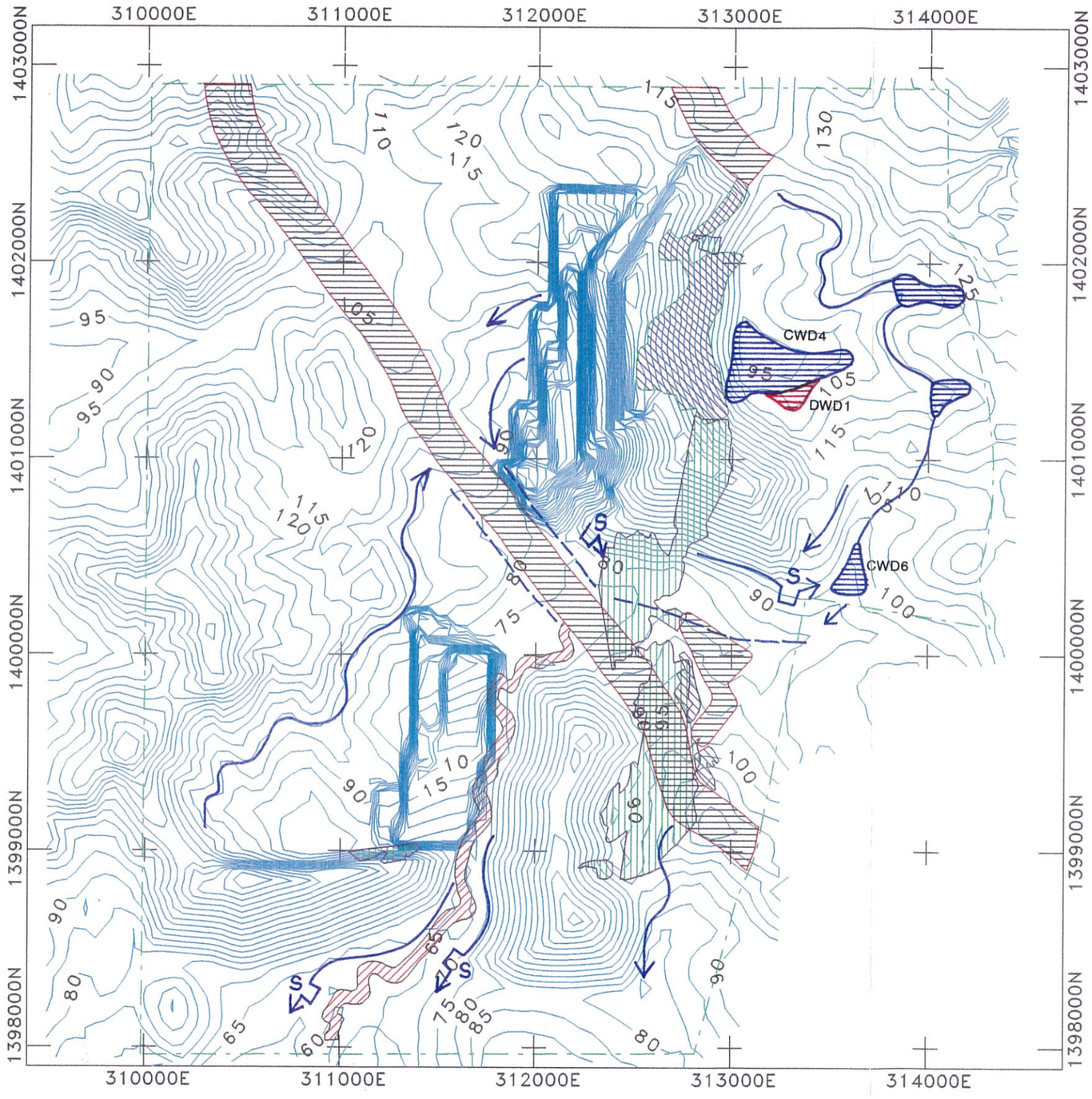
NOTE: FOR DIAGRAMMATIC PURPOSES ONLY - NOT TO SCALE

ENVIROSCIENCES PTY LIMITED

PROJECT No.: F1111

LANDFORM AT THE END OF YEAR 1

FIG. 18



LEGEND:

- Underground Workings
- Barriers – Highway, Railway & Coke Oven
- Open Cut Workings
- Rixs Creek Barrier
- Lease Boundary

CONCEPTUAL WATER MANAGEMENT STRUCTURES

- Clean Water Dam
- Dirty Water Dam
- Clean Water Drainage Line
- Diversion Bank
- Sediment Control System

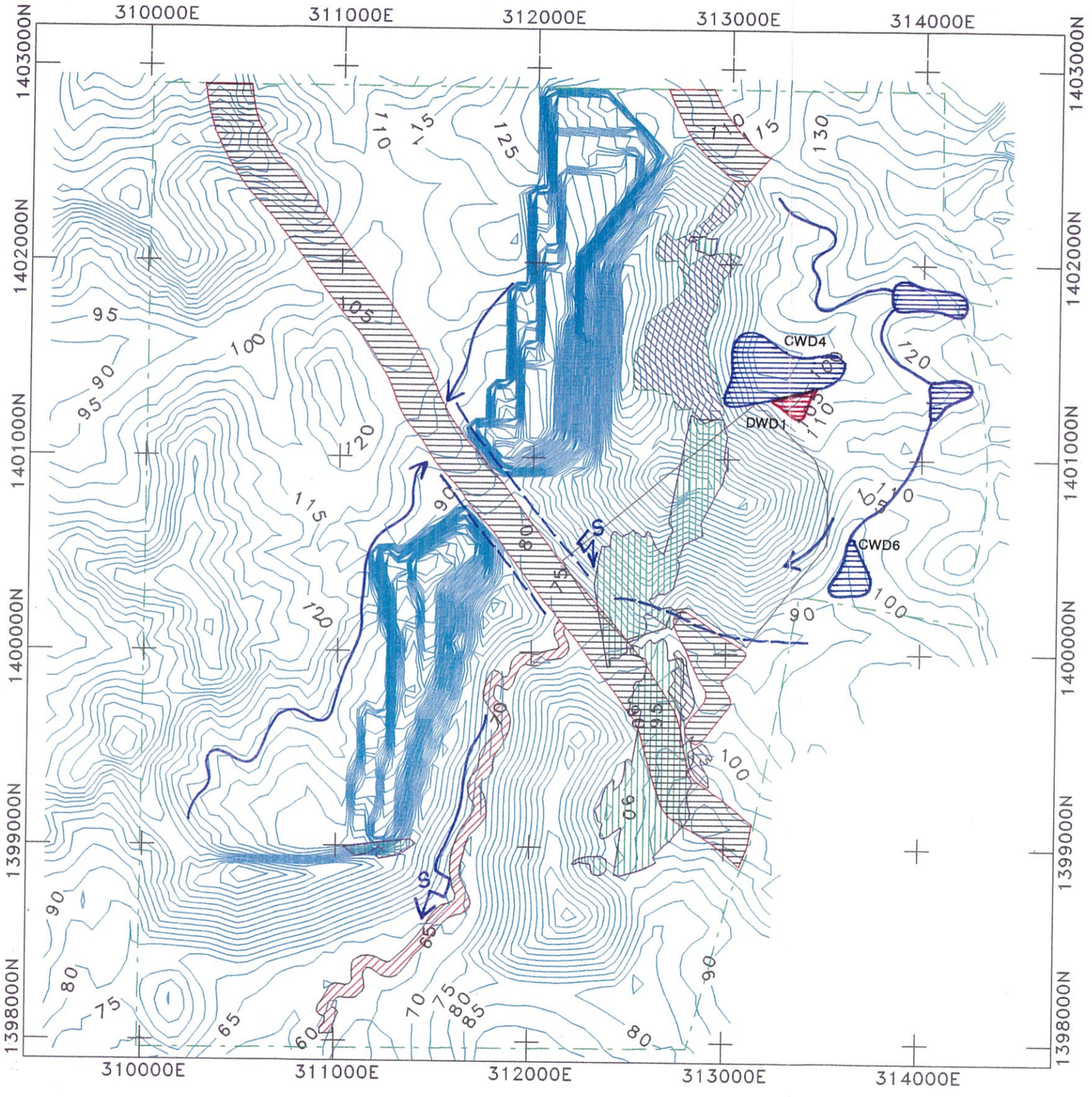
NOTE: FOR DIAGRAMMATIC PURPOSES ONLY - NOT TO SCALE

ENVIROSCIENCES PTY LIMITED

PROJECT No.: F1111

LANDFORM AT THE END OF YEAR 8

FIG. 19



LEGEND:

- Underground Workings
- Barriers – Highway, Railway & Coke Ovens
- Open Cut Workings
- Rixs Creek Barrier
- Lease Boundary

CONCEPTUAL WATER MANAGEMENT STRUCTURES

- Clean Water Dam
- Dirty Water Dam
- Clean Water Drainage Line
- Diversion Bank
- Sediment Control System

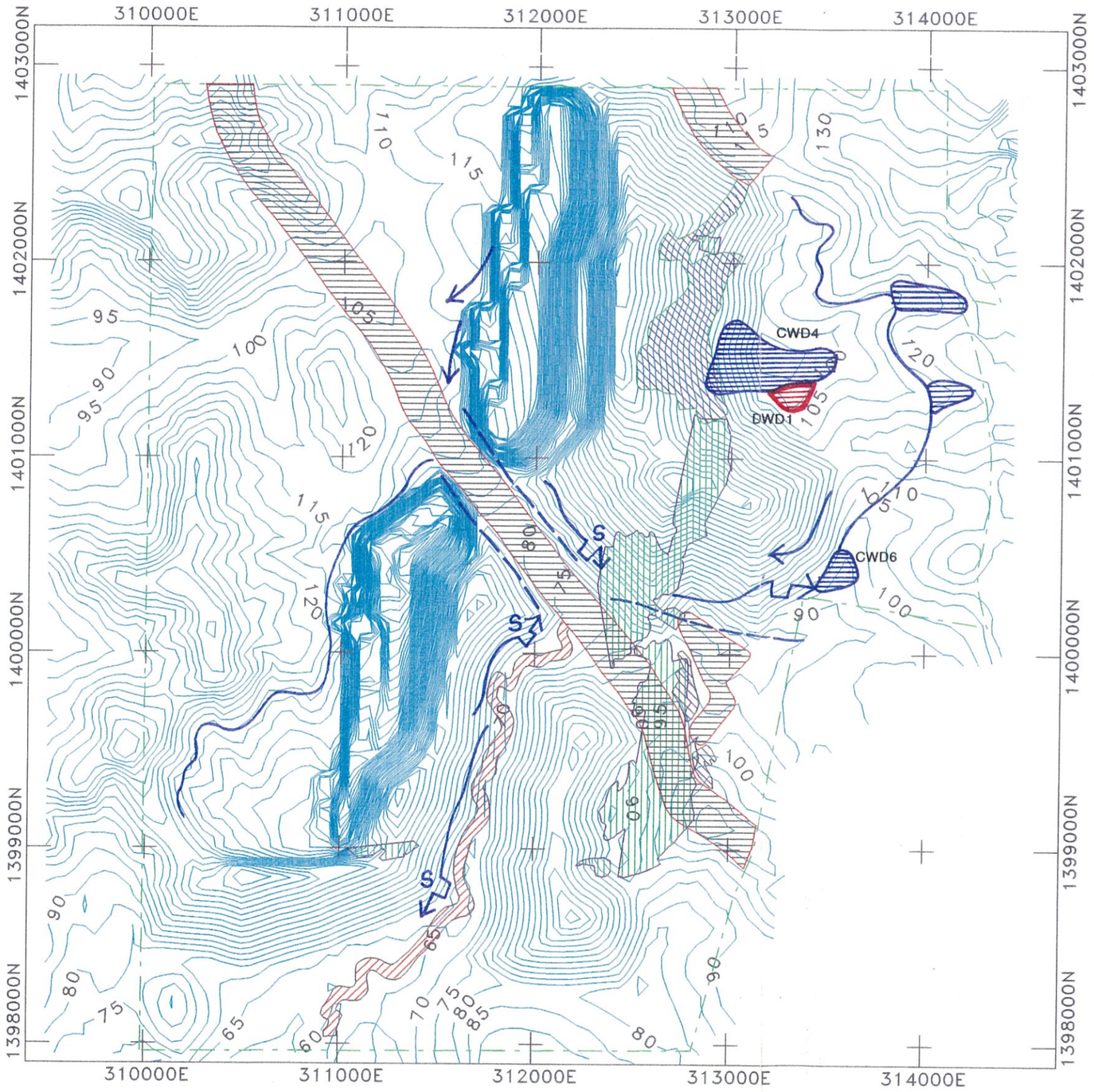
NOTE: FOR DIAGRAMMATIC PURPOSES ONLY - NOT TO SCALE

ENVIROSCIENCES PTY LIMITED

PROJECT No.: F1111

LANDFORM AT THE END OF YEAR 15

FIG. 20



LEGEND:

- Underground Workings
- Barriers – Highway, Railway & Coke Ovens
- Open Cut Workings
- Rixs Creek Barrier
- Lease Boundary

CONCEPTUAL WATER MANAGEMENT STRUCTURES

- Clean Water Dam
- Dirty Water Dam
- Clean Water Drainage Line
- Diversion Bank
- Sediment Control System

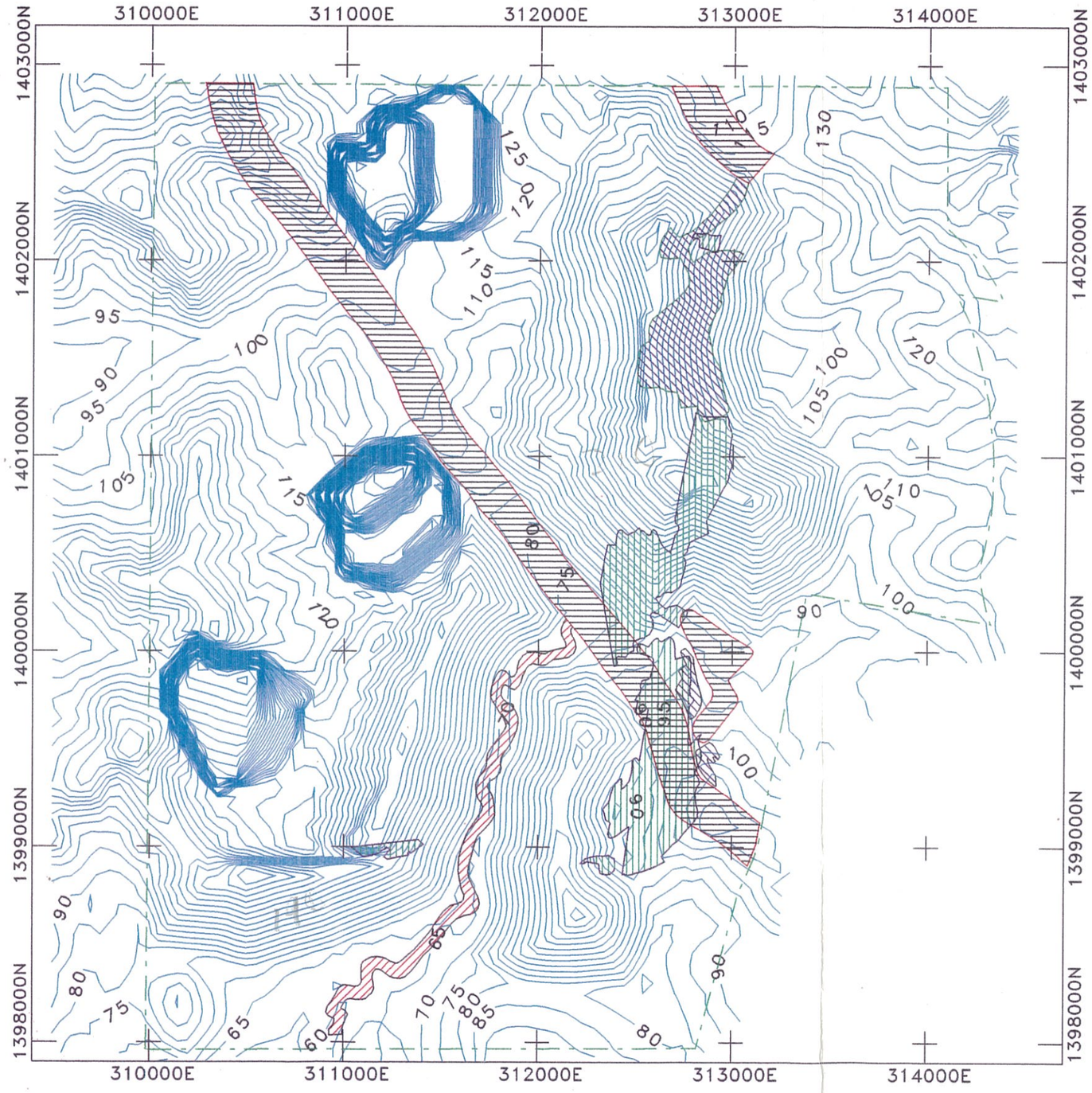
NOTE: FOR DIAGRAMMATIC PURPOSES ONLY - NOT TO SCALE

ENVIROSCIENCES PTY LIMITED

PROJECT No.: F1111

LANDFORM AT THE END OF YEAR 22

FIG. 21



LEGEND

- Underground Workings
- Barriers – Highway, Railway & Coke Ovens
- Open Cut Workings
- Rixs Creek Barrier
- Lease Boundary

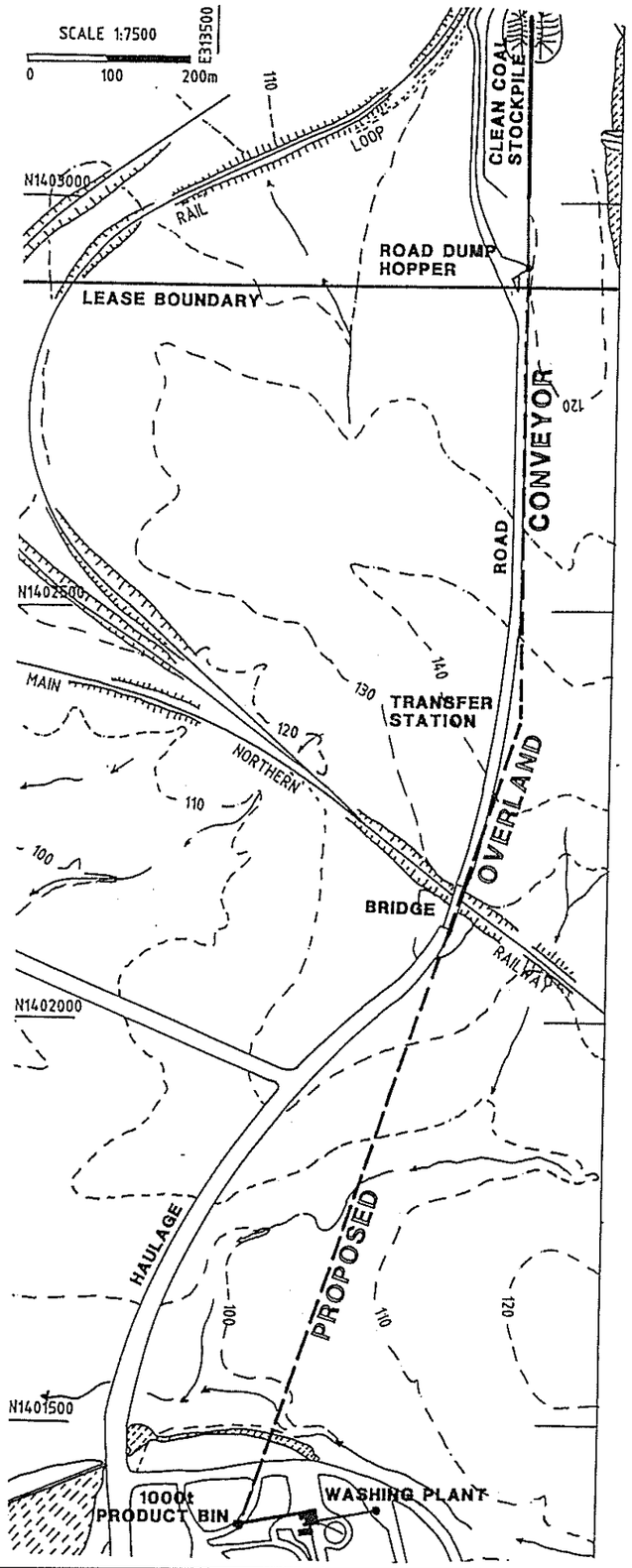
NOTE: FOR DIAGRAMMATIC PURPOSES ONLY - NOT TO SCALE

ENVIROSCIENCES PTY LIMITED

PROJECT No.: F1111

LANDFORM AT THE COMPLETION OF MINING

FIG. 22

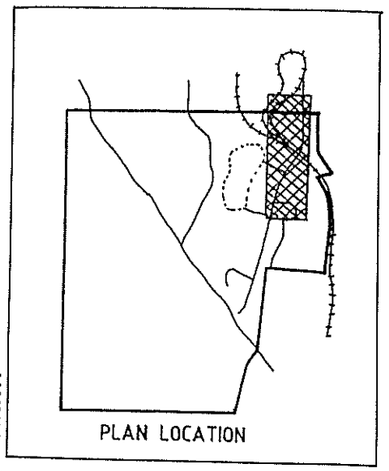


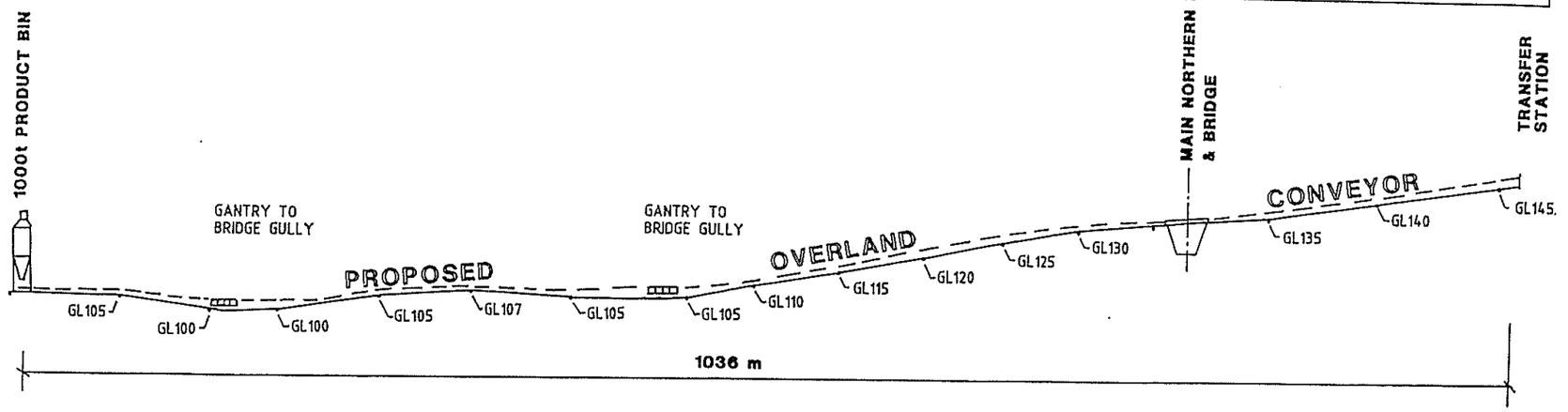
CROSS SECTIONS

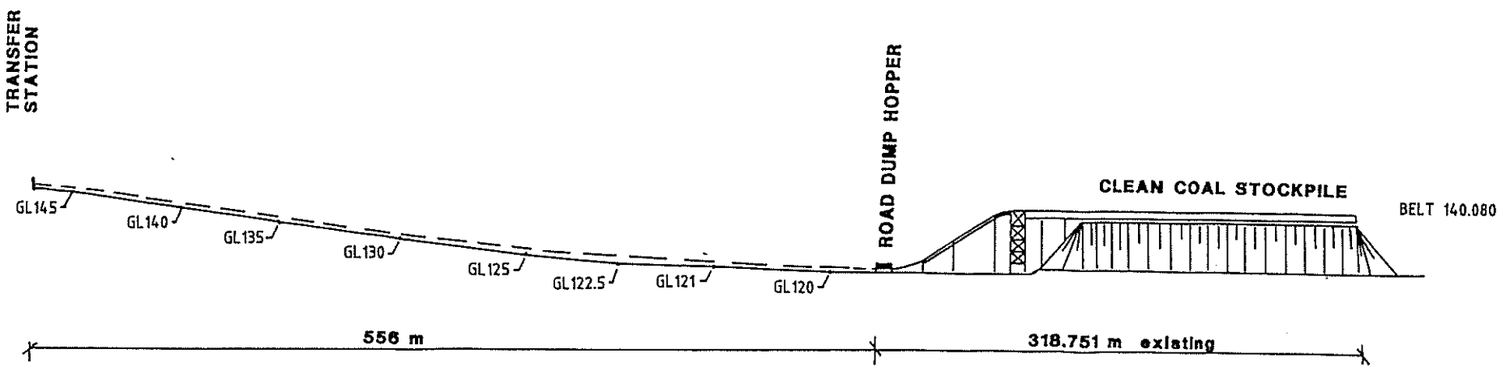
Scale 1:4000

0 100 200m

VERTICAL EXAGGERATION 2.0





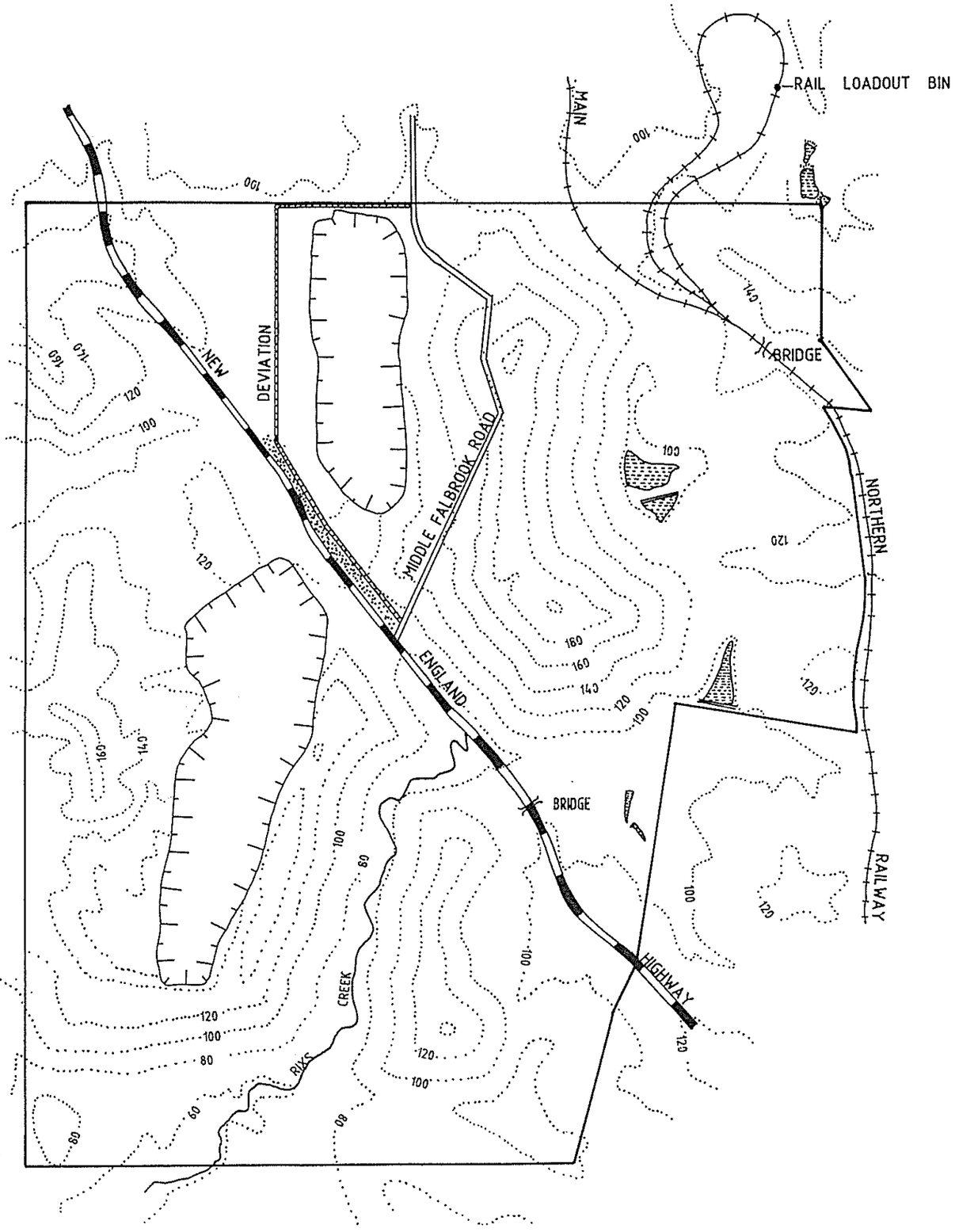


ENVIROSCIENCES PTY LIMITED

PROJECT No.: F1127

PROPOSED OVERLAND CONVEYOR

FIG. 23



LEGEND

- LEASE BOUNDARY
- PROPOSED DEVIATION
- DISTURBED OPEN CUT AREA
- 5m HIGH BUND

N

Scale 1 : 25000

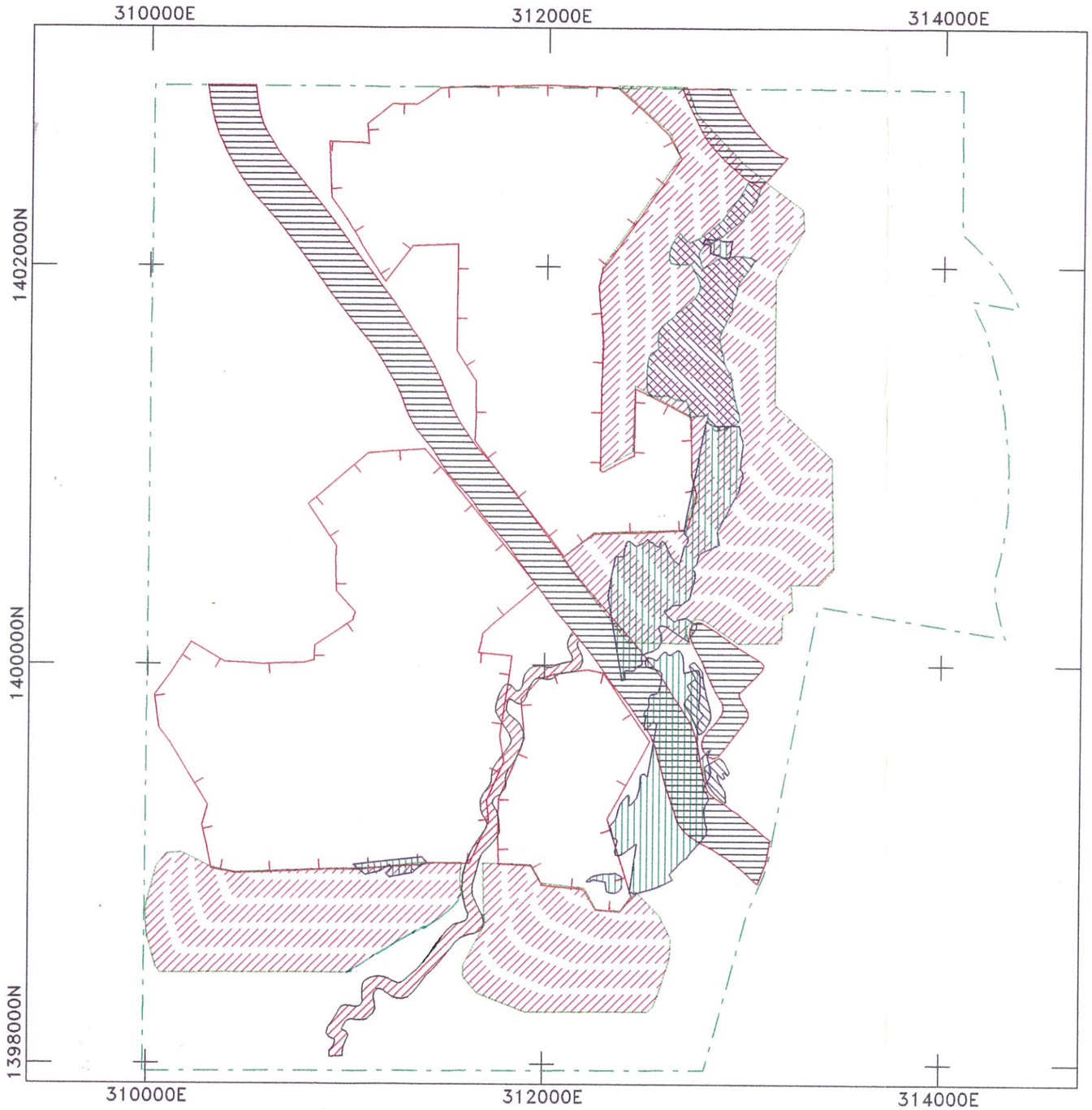
0 1000m

ENVIROSCIENCES PTY LIMITED

PROJECT No.: F1127

RELOCATION OF
MIDDLE FALBROOK ROAD

FIG. 24



Plot showing pit limits, out of pit dumps and base map data

Statistics for out of pit dumps:

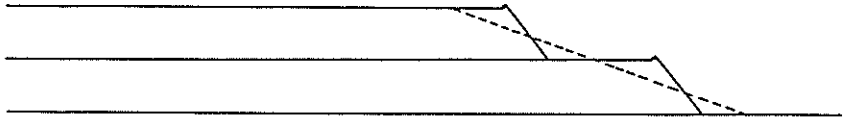
	Plan Area (Hectares)	Surface Area (Hectares)	Out of Pit Volume (Cubic Metres x 1000)
Pit 1	215.8	218.9	92693.0
Pit 2	58.1	58.8	14437.0
Pit 3	78.3	80.1	16481.9
Total	352.2	357.8	123611.9

LEGEND:

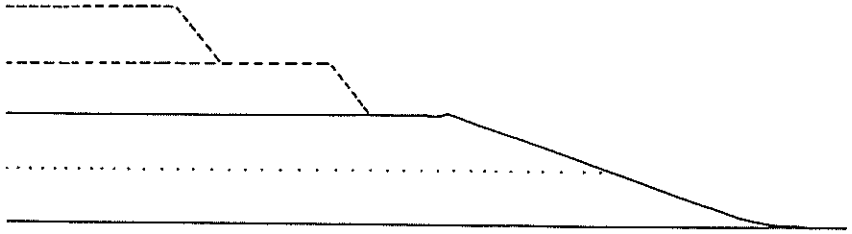
- Out–of–pit overburden dumping
- Underground Workings
- Barriers – Highway, Railway & Coke Ovens
- Open Cut Workings
- Rixs Creek Barrier
- Lease Boundary

NOTE: NOT TO SCALE - FOR DIAGRAMMATIC PURPOSES ONLY

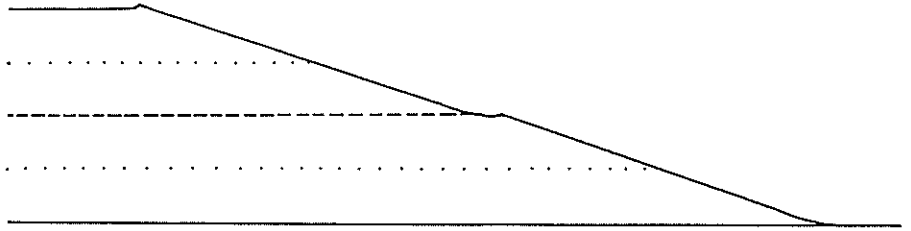
1. TWO DUMP LIFTS (GENERALLY 10m EACH) ARE DEVELOPED OVER AN AREA WHERE TOPSOIL HAS BEEN REMOVED.



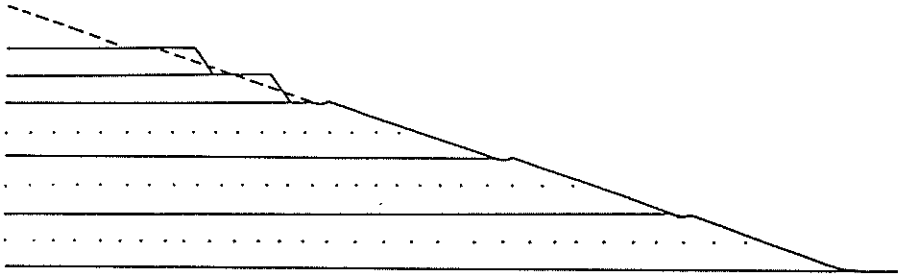
2. DUMP FACES ARE RESHAPED TO A MAXIMUM SLOPE OF 10° . FURTHER DUMP LIFTS ARE DEVELOPED IF NECESSARY.



3. NEW DUMP FACES ARE RESHAPED ALLOWING FOR A DRAINAGE CHANNEL BETWEEN EACH RESHAPED SECTION TO CONTROL RUNOFF.



4. FURTHER DUMP LIFTS ARE DEVELOPED IN PAIRS IF NECESSARY AND RESHAPED, MAINTAINING A DRAINAGE CHANNEL BETWEEN EACH SECTION.

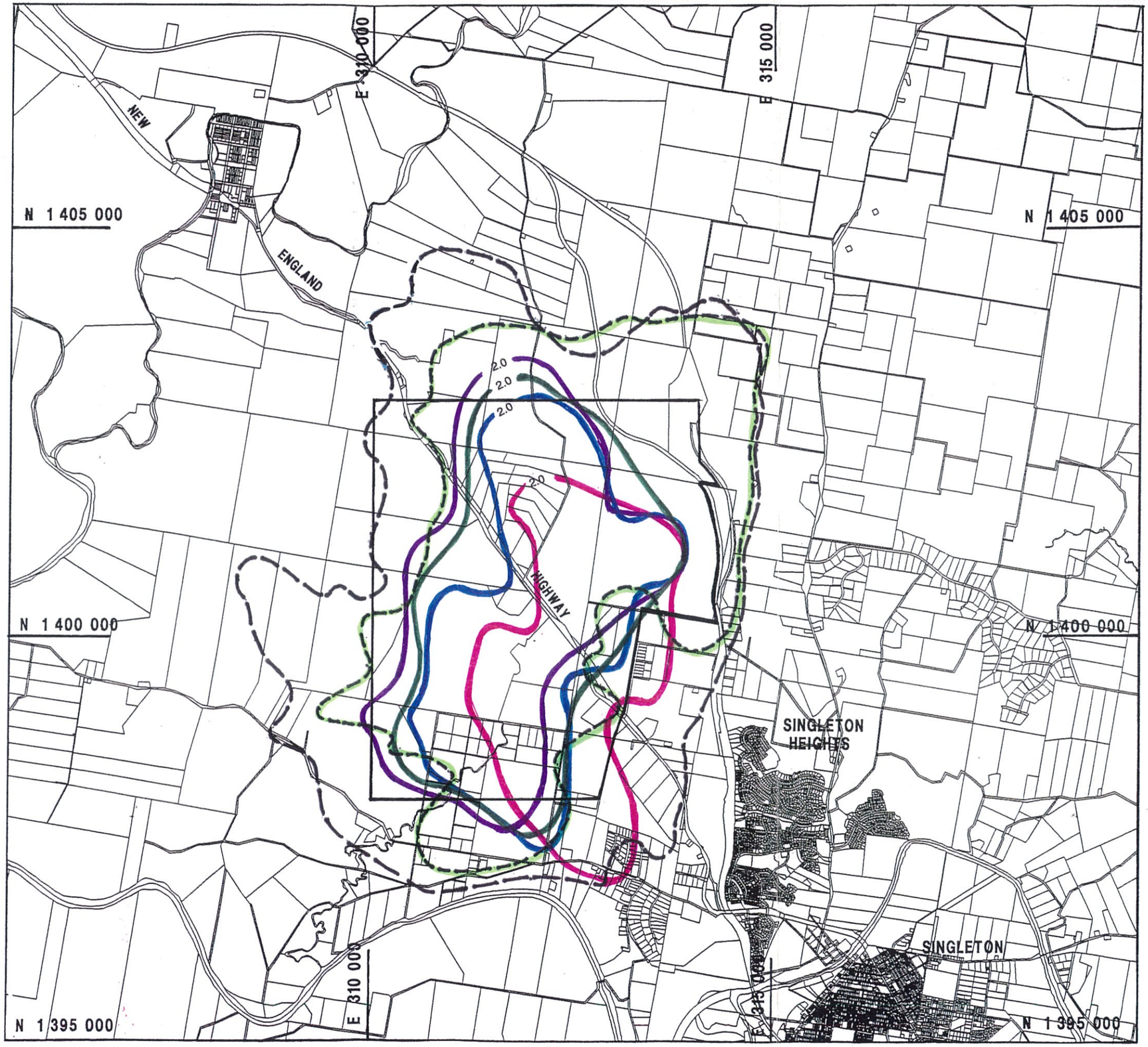


ENVIROSCIENCES PTY LIMITED

PROJECT No.: F1127

OUT OF PIT
DUMP DEVELOPMENT

FIG. 25a



LEGEND:

- LEASE BOUNDARY
- PREDICTED 38dB(A) L_{10} NOISE CONTOUR LEVEL - DAY TIME
- PREDICTED 38dB(A) L_{10} NOISE CONTOUR LEVEL - NIGHT TIME

PREDICTED ANNUAL AVERAGE DUST DEPOSITION DUE TO EMISSIONS FROM RIXS CREEK IN:-

- YEAR 1 - g/m²/month
- YEAR 8 - g/m²/month
- YEAR 15 - g/m²/month
- YEAR 22 - g/m²/month

N

SCALE 1 : 50 000

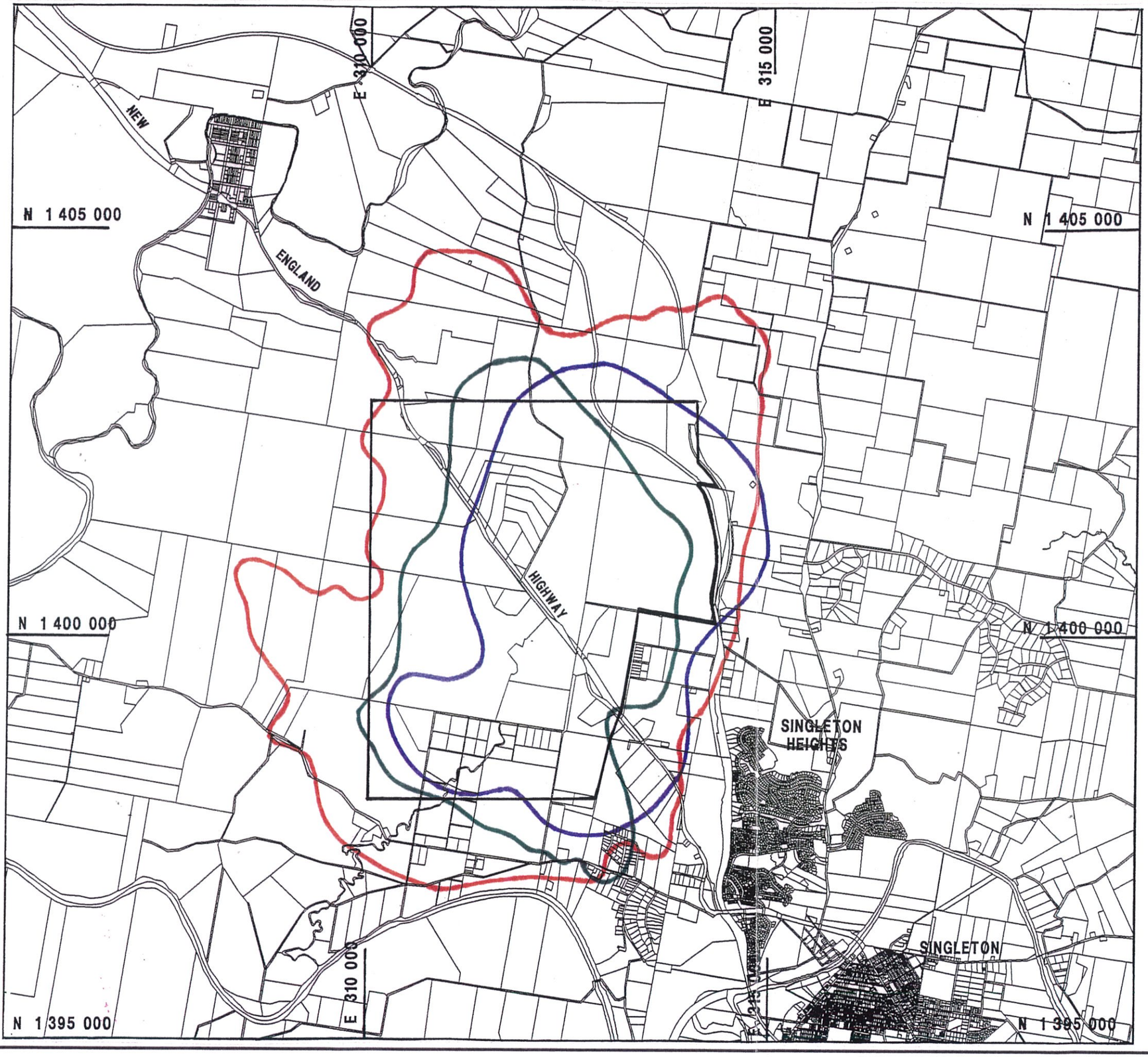
0 2 000m

ENVIROSCIENCES PTY LIMITED

PROJECT No.: F1127

PREDICTED INCREASE IN NOISE AND DUST

FIG. 26



LEGEND:

- LEASE BOUNDARY
- PREVIOUS AREA OF AFFECTATION
- MODELLED AREA AFFECTED BY DUST
- MODELLED AREA AFFECTED BY NOISE

N

SCALE 1 : 50 000

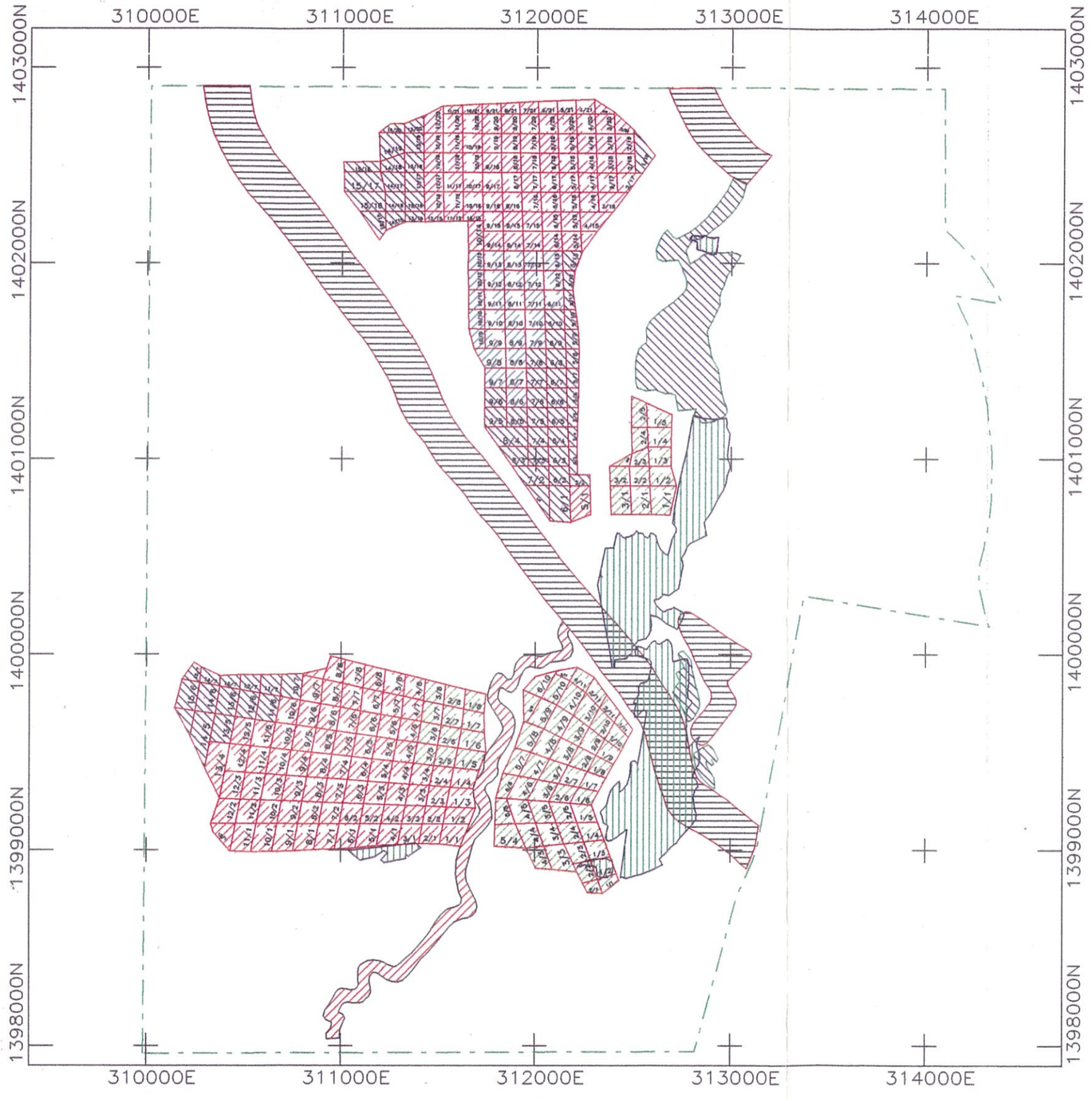
0 2 000m

ENVIROSCIENCES PTY LIMITED

PROJECT No.: F1127

MODELLED AREAS OF AFFECTATION

FIG. 27



LEGEND

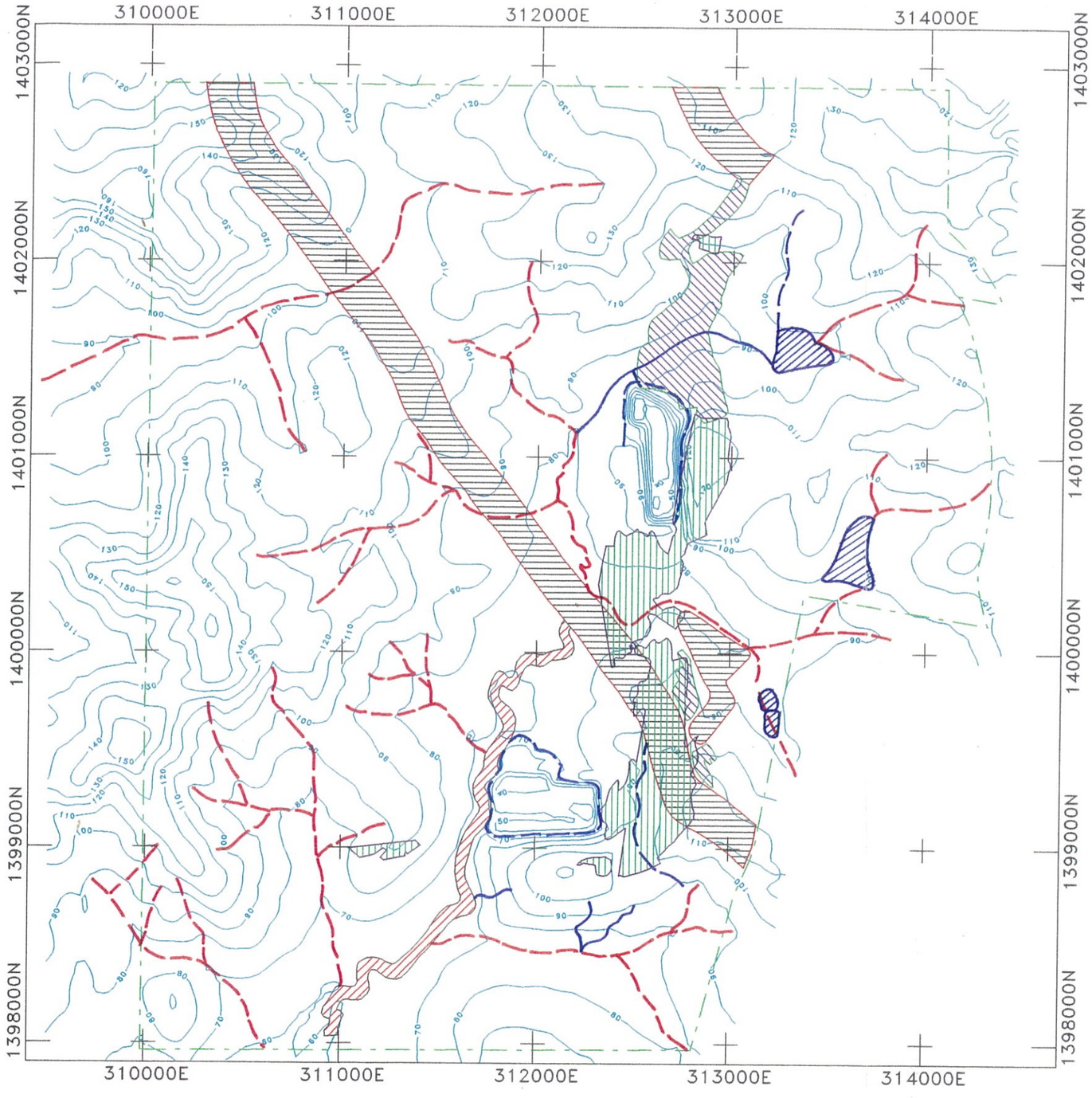
- Underground Workings
- Barriers – Highway, Railway & Coke Ovens
- Open Cut Workings
- Rixs Creek Barrier
- Lease Boundary

ENVIROSCIENCES PTY LIMITED

PROJECT No.: F1127

ALTERNATIVE CONCEPTUAL MINE PLAN

FIG. 28



LEGEND:

EXISTING DRAINAGE LINES

PROPOSED DRAINAGE LINES

PROPOSED CONTOUR DRAIN

LEGEND

Underground Workings

Barriers – Highway, Railway & Coke Ovens

Open Cut Workings

Rixs Creek Barrier

Lease Boundary

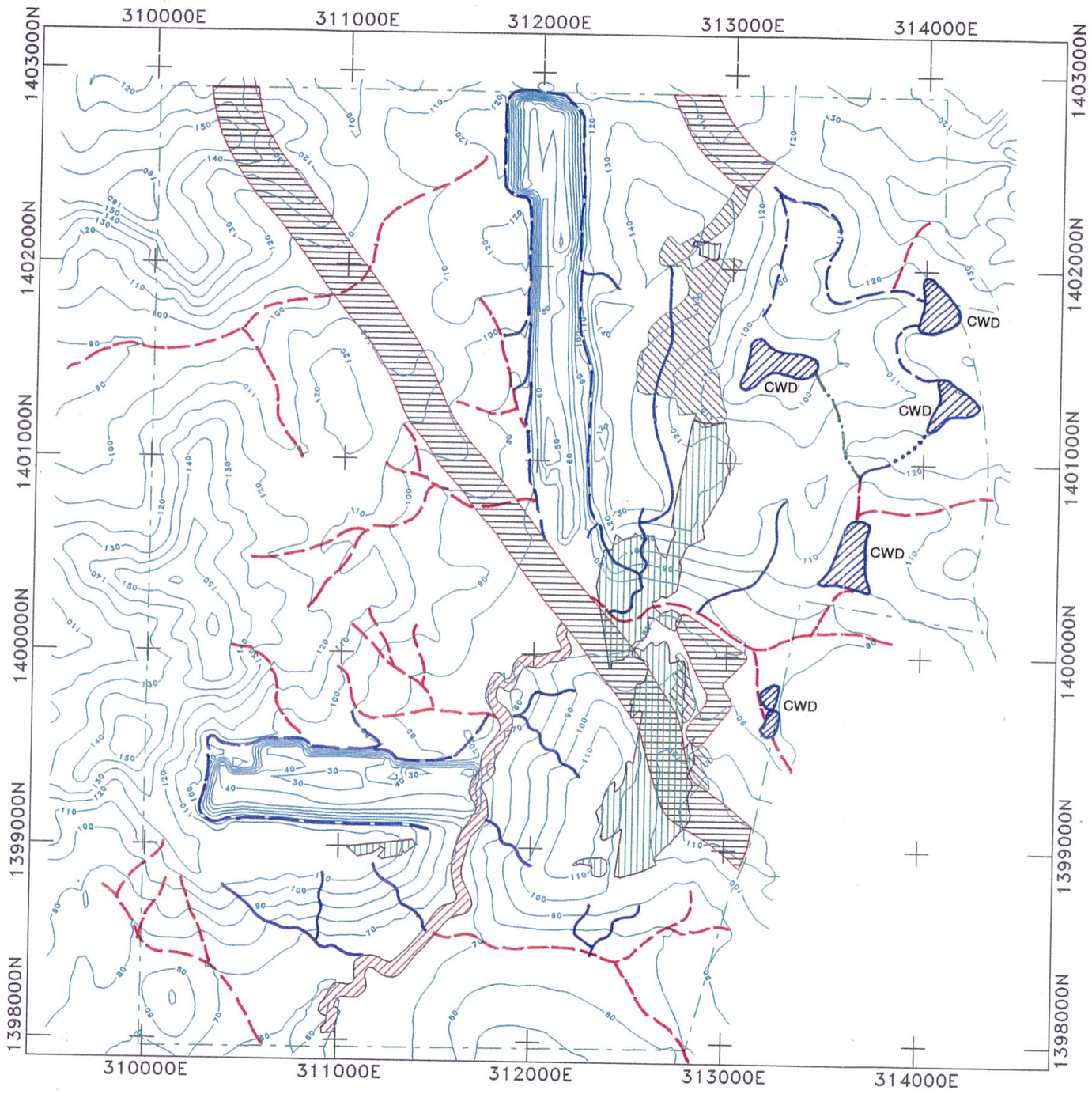
NOTE: NOT TO SCALE - FOR DIAGRAMMATIC PURPOSES ONLY

ENVIROSCIENCES PTY LIMITED

PROJECT No.: F1127

LANDFORM AT END OF YEAR 1 - ALTERNATIVE MINE PLAN

FIG. 29



LEGEND:

- EXISTING DRAINAGE LINES
- PROPOSED DRAINAGE LINES
- PROPOSED CONTOUR DRAIN
- PROPOSED DRAINAGE CHANNEL
- PROPOSED PUMP LINE

LEGEND

- Underground Workings
- Barriers — Highway, Railway & Coke Ovens
- Open Cut Workings
- Rixs Creek Barrier
- Lease Boundary

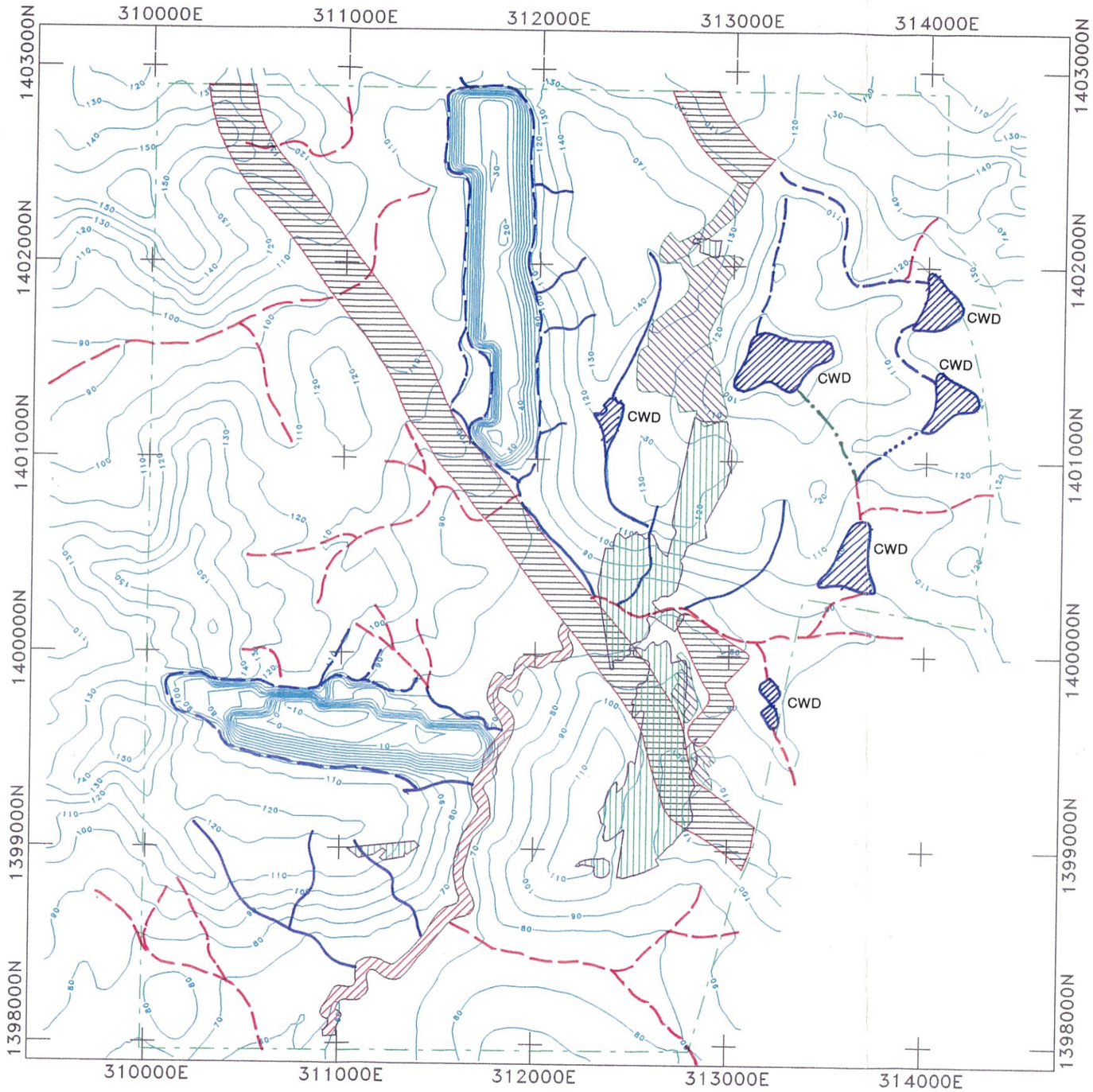
NOTE: NOT TO SCALE - FOR DIAGRAMMATIC PURPOSES ONLY

ENVIROSCIENCES PTY LIMITED

PROJECT No.: F1127

LANDFORM AT END OF YEAR 8 - ALTERNATIVE MINE PLAN

FIG. 30



LEGEND:

- EXISTING DRAINAGE LINES
- PROPOSED DRAINAGE LINES
- PROPOSED CONTOUR DRAIN
- PROPOSED DRAINAGE CHANNEL
- PROPOSED PUMP LINE

LEGEND

- Underground Workings
- Barriers – Highway, Railway & Coke Ovens
- Open Cut Workings
- Rixs Creek Barrier
- Lease Boundary

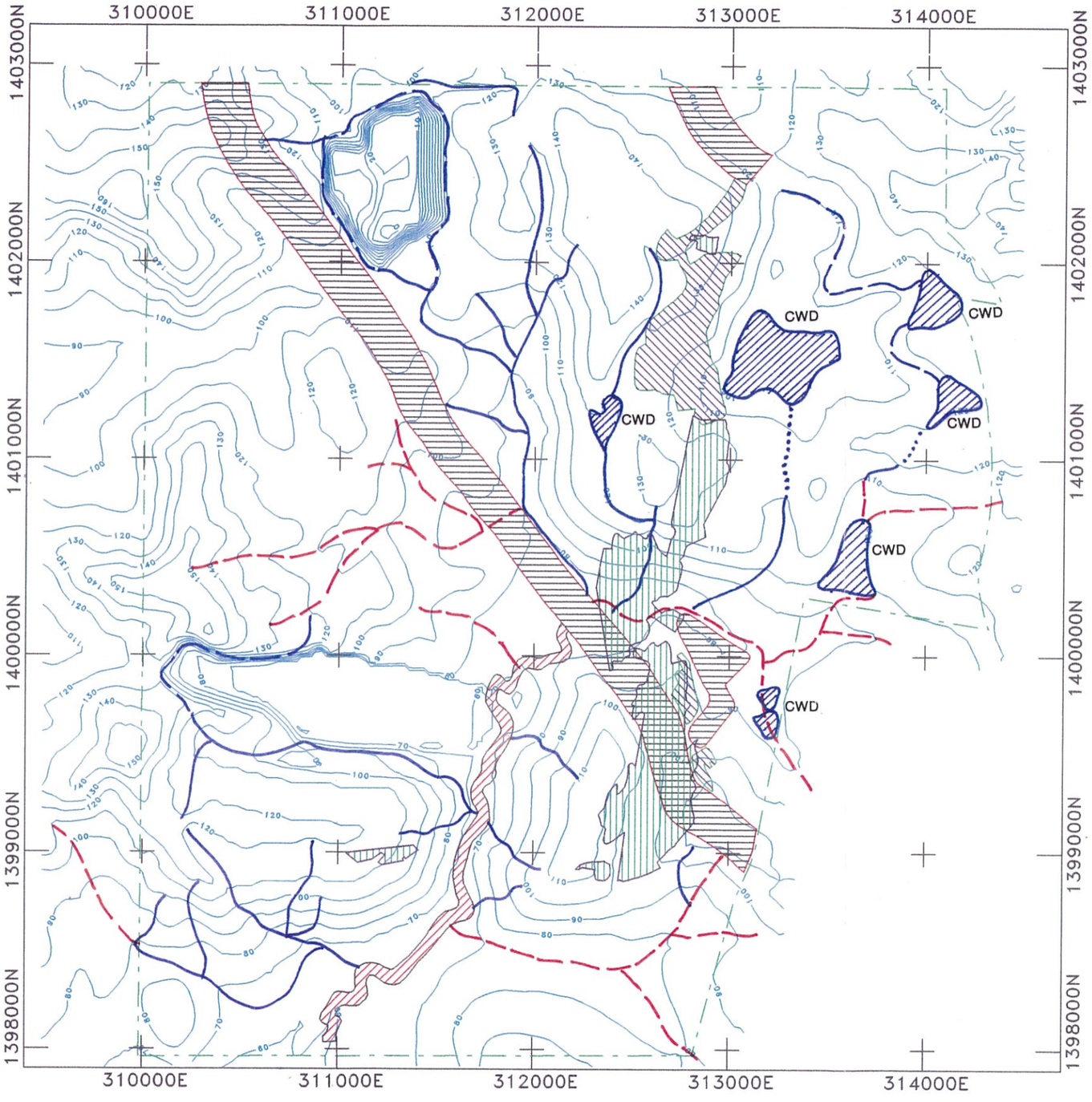
NOTE: NOT TO SCALE - FOR DIAGRAMMATIC PURPOSES ONLY

ENVIROSCIENCES PTY LIMITED

PROJECT No.: F1127

LANDFORM AT END OF YEAR 15 - ALTERNATIVE MINE PLAN

FIG. 31



LEGEND:

- EXISTING DRAINAGE LINES
- PROPOSED DRAINAGE LINES
- PROPOSED CONTOUR DRAIN
- PROPOSED DRAINAGE CHANNEL
- PROPOSED PUMP LINE

LEGEND

- Underground Workings
- Barriers – Highway, Railway & Coke Ovens
- Open Cut Workings
- Rixs Creek Barrier
- Lease Boundary

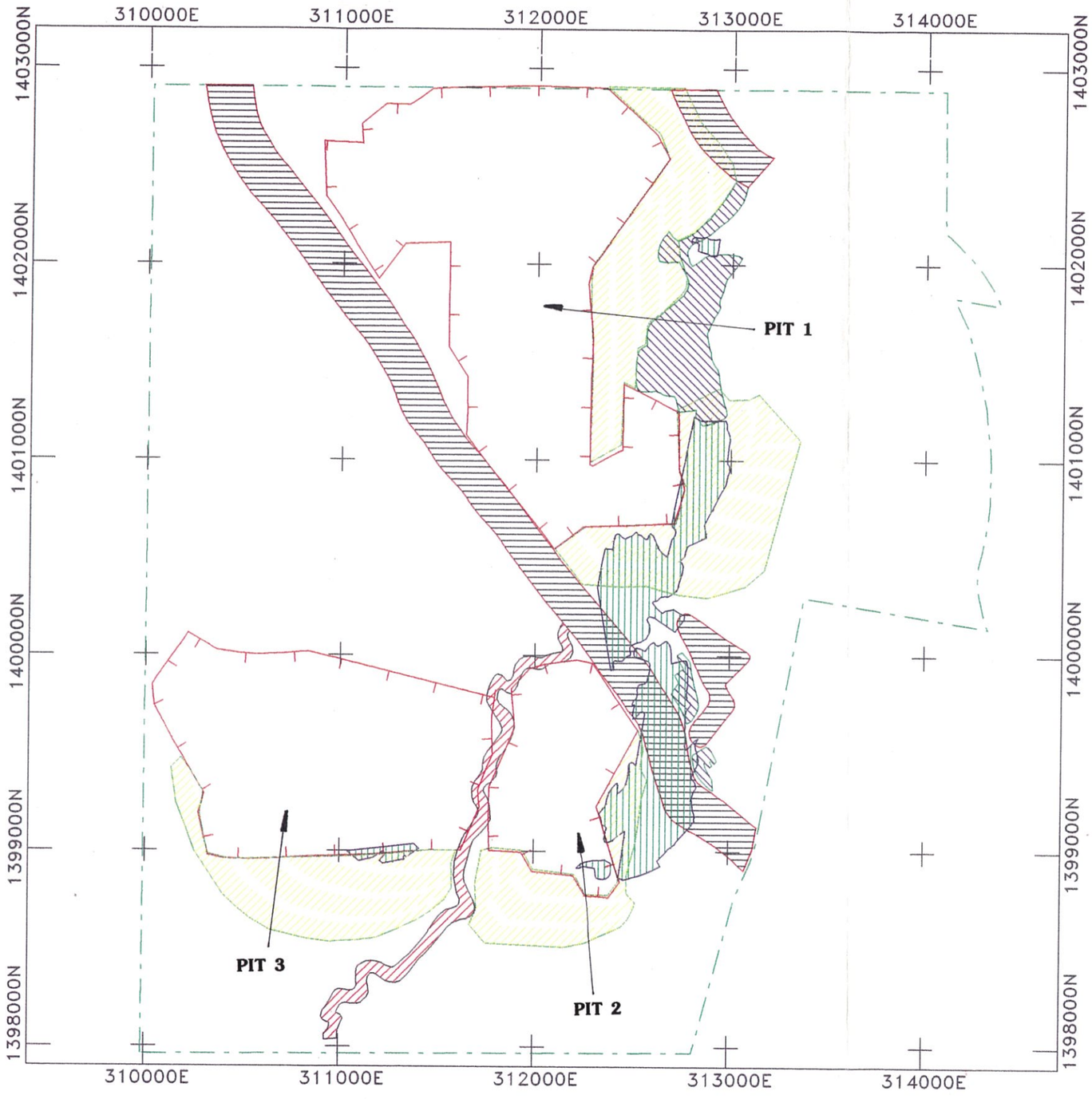
NOTE: NOT TO SCALE - FOR DIAGRAMMATIC PURPOSES ONLY

ENVIROSCIENCES PTY LIMITED

PROJECT No.: F1127

LANDFORM AT COMPLETION OF MINING
ALTERNATIVE MINE PLAN

FIG. 32



Plot showing pit limits, out of pit dumps and base map data

Statistics for out of pit dumps:

	Plan Area (Hectares)	Surface Area (Hectares)	Out of Pit Volume (Cubic Metres x 1000)
Pit 1	128.1	128.6	22362.9
Pit 2	38.9	39.1	5194.9
Pit 3	49.2	49.6	7801.9
Total	216.2	217.3	27430.2

LEGEND

- Underground Workings
- Barriers – Highway, Railway & Coke Ovens
- Open Cut Workings
- Rixs Creek Barrier
- Lease Boundary
- Out of pit overburden dumping

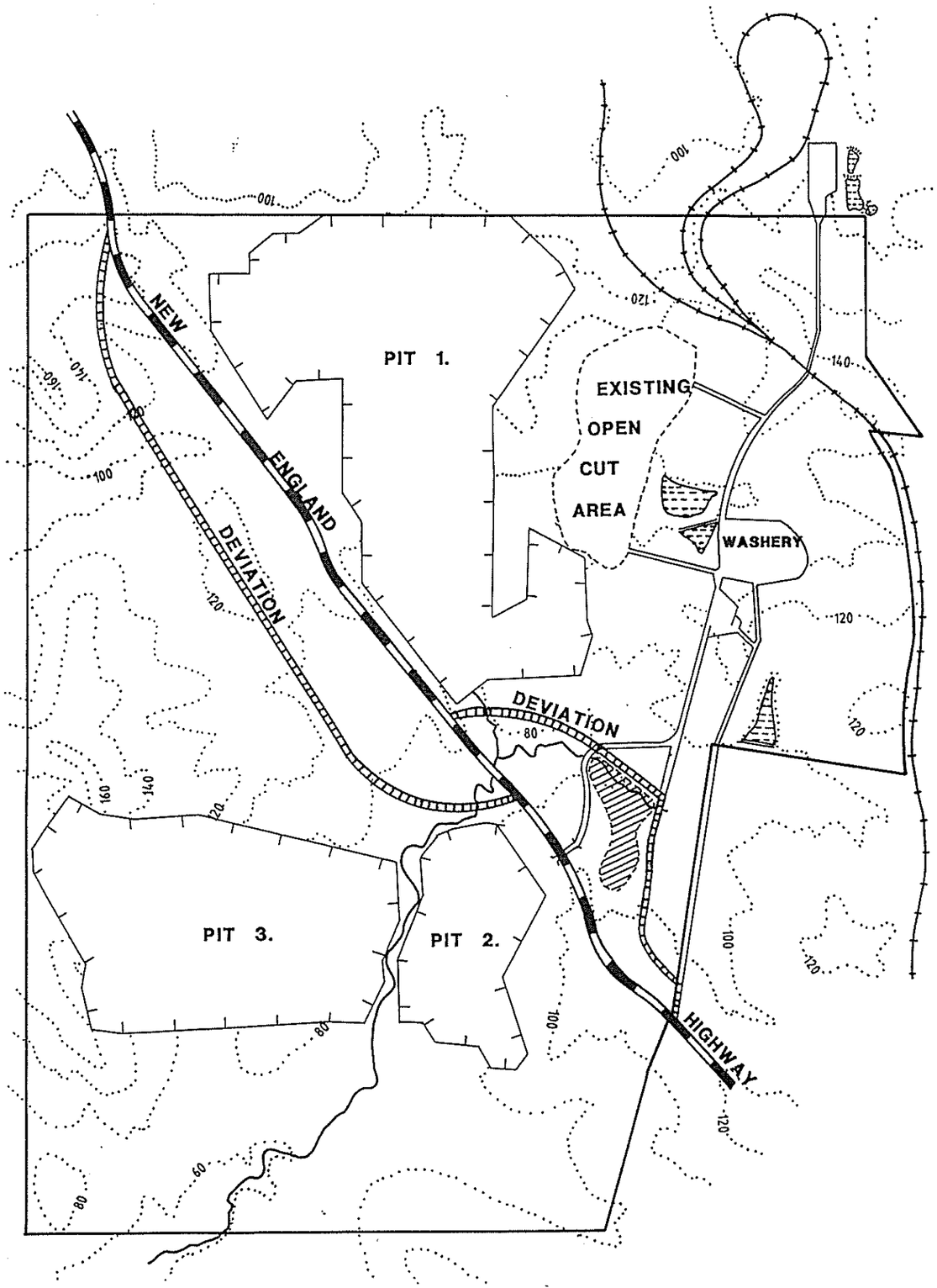
NOTE: NOT TO SCALE - FOR DIAGRAMMATIC PURPOSES ONLY

ENVIROSCIENCES PTY LIMITED

PROJECT No.: F1127

OUT OF PIT OVERBURDEN DUMPING - ALTERNATIVE MINE PLAN

FIG. 33



LEGEND

- LEASE BOUNDARY
- PROPOSED DEVIATION
- PROPOSED OPEN CUT AREA

N

SCALE 1 : 25 000

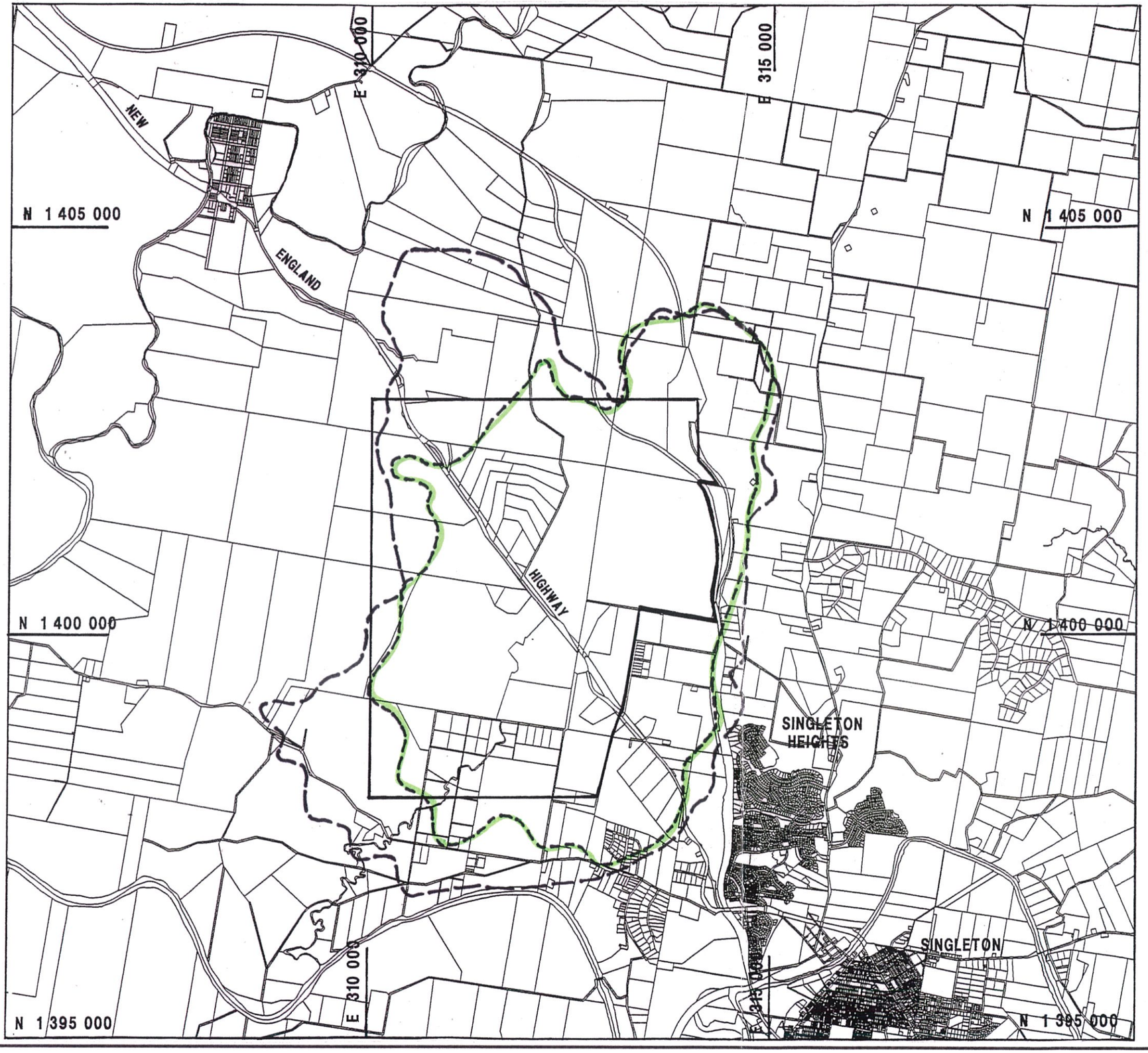
0 1000m

ENVIROSCIENCES PTY LIMITED

PROJECT No.: F1127

PROPOSED NEW ENGLAND HIGHWAY DEVIATIONS
FOR ALTERNATIVE MINE PLAN

FIG. 34



LEGEND:

PREDICTED 38dB(A)L
NOISE CONTOUR LEVEL - DAY TIME

PREDICTED 38dB(A)L
NOISE CONTOUR LEVEL - NIGHT TIME

N

SCALE 1 : 50 000

0 2 000m

ENVIROSCIENCES PTY LIMITED

PROJECT No.: F1127

PREDICTED INCREASE IN NOISE -
ALTERNATIVE MINE PLAN

FIG. 35