an **AMCOAL** company

LANDAU COLLIERY

SOUTH AFRICAN COAL ESTATES

Final Report for the Schoongezicht

No 2 Seam Minipit

An Addendum to the Report for Landau Colliery

Dated July 1997

2044

AMCOAL COLLIERY AND INDUSTRIAL OPERATIONS LIMITED

THE ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

FOR

LANDAU COLLIERY

A SECTION OF SOUTH AFRICAN COAL ESTATES

Final Report for the Schoongezicht

No 2 Seam Minipit

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A. EXECUTIVE SUMMARY

This application for a mini-pit mining operation arises from an increase in the demand for export coal through the Richards Bay Coal Terminal (RBCT) in which Amcoal has a share and the imminent closure of the No 4 Seam mini-pit. The re-opening of the 2 Seam mini-pit will allow Amcoal to participate in sourcing its share of the demand which will be beneficial to the country in terms of foreign exchange and continued employment of people associated with the No 4 Seam mini-pit. Landau Colliery has an agreement with the Witbank Town Council (WTC) to transfer the post-mining surface to the council for development of the Schoongezicht Suburb, which the Witbank Town Council believes is urgent, as they would like to proceed with the development.

The Schoongezicht 2 Seam Mini-pit was partially mined between 1987 and 1990, and was closed due to an economic down turn of the export coal market. A highwall and void was left for mining to continue when the economic situation improved.

After completion of mining the area will be rehabilitated and used for development of the Schoongezicht township and associated infrastructure.

The provisional Environmental Management Programme Report for the Schoongezicht No 2 Seam Mini-Pit was submitted on 13th February 1997, a period of consultation with the relevant Government Authorities followed and once all conditions laid down had been complied with, temporary Mining Authorisation Ref OT 6/2/2/141 was granted on 12th May 1997, with the provision that a final Environmental Management Programme be submitted by 31st July 1997. Copies of all permissions and relevant correspondence are included in Supplementary Report No 3.

Mining of the mini-pit will be carried out by a contractor who will deliver the crushed coal to either the Klipfontein or Navigation plants or direct to the Rapid Loading Terminal by road haulage. Mini-pit mining will be carried out using conventional bowl scrapers and shovel and truck operations and two small crawler draglines. The two plants, Klipfontein and Navigation, with their associated discard disposal facilities are described in the Kleinkopje and Landau Colliery EMPR's respectively.

Development of the mini-pit will be such that it will not impact adversely on the present clean and dirty water systems as described in the Landau Colliery EMPR. After closure, ground-water emanating from the mini-pit will be dealt with in accordance with recommendations made by the Hydrological Consultants, full details of which are supplied in report No 3591/1471/1W.

"Surface and Groundwater Aspects of the Environmental Mangament Programme for the proposed Schoongezicht 2 Seam Mini-Pit". Prepared for South African Coal Estates - Landau Colliery by Wates, Meiring & Barnard. Supplementary Report No. 4.

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PART 1: BRIEF PROJECT DESCRIPTION

1.1 NAME AND ADDRESS OF MINE, MINE OWNER, MINE MANAGER AND RESPONSIBLE HEAD OFFICE PERSON

All communications should in the first instance be directed to:

Postal:	The Mine Manager: Landau Colliery P O Box 78 CLEWER 1036
Telefax:	(0135) 656 9016
Telephone:	(0135) 656 9000 / (0135) 913 3602

Thereafter the Consulting Engineer who may be contacted at:

Postal:	Coal II Amcoal Colliery & Industrial Operations Ltd P O Box 61587 MARSHALLTOWN 2107
Telefax No:	(011) 638 2645
Telegraph:	Anmercosa
Telephone:	(011) 638 9111

The company registration number of the mine is:

Reg No. 01/06730/06

The location of the mini-pit mine is shown on Fig 1.1.

1.2 NAME AND ADDRESS OF THE MINERAL RIGHTS HOLDER

The mineral rights are held by:

Amcoal Colliery and Industrial Operations Limited

Postal Address:	P O Box 61587 Marshalltown 2107
Physical Address:	44 Main Street Johannesburg 2000

The areas over which coal rights are held by Landau Colliery are shown in Figure 1.2.

A temporary mining authorization has been granted dated 12th May 1997 reference OT 6/2/2/141 - Addendum No. 1.

Figure 1.3 shows the location of coal reserves held by this colliery in the Schoongezicht area.

1.3 NAME AND ADDRESS OF THE HOLDER OF THE MINING AUTHORIZATION

The Manager
Landau Colliery
P O Box 78
CLEWER
1036

1.4 NAME AND ADDRESS OF THE OWNER OF THE LAND AND THE TITLE DEED DESCRIPTION

Amcoal Colliery and Industrial Operations Ltd

Postal Address: P O Box 61587
Marshalltown
2107

Physical Address: 44 Main Street
Johannesburg
2000

1.5 REGIONAL SETTING

1.5.1 The Schoongezicht No 2 Seam mini-pit mine is situated in the Witbank magisterial district and is served by the Highveld Regional Services Council.

1.5.2 The mini-pit mine is situated 4km southwest of Witbank.

1.5.3 Figure 1.4 shows the location of the mini-pit mine and Navigation plant in relation to Witbank and also infrastructure serving the area.

1.5.4 Infrastructure services shown on Figure 1.4 are covered by servitudes over properties they traverse. Details of these servitudes can be made available if required.

1.5.5 The mini-pit and Navigation plant are situated in the Olifants River Catchment number 210 and Wilge River Catchment number 220.

1.6 DESCRIPTION OF THE PROJECT

1.6.1 The mineral to be mined is a bituminous coal deposit.

1.6.2 The mini-pit mine will extract some 1.14 Mt/pa of bituminous coal. Of this 0.25 Mt/pa will go direct to the Rapid Loading Terminal (RLT) as raw coal, the balance of 0.89 Mt/pa will go to the Klipfontein and Navigation coal washing plants for processing.

1.6.3 The economic reserves total 3.62 million ROM tons which will yield some 2.6 million tons of steam coal.

1.6.4 Mining of the mini-pit will be carried out by a contractor who will deliver the crushed coal to either the Klipfontein or Navigation plants or direct to the Rapid Loading Terminal by road haulage. Mini-pit mining will be carried out using conventional bowl scrapers and shovel and truck operations and two small crawler draglines. The two plants, Klipfontein and Navigation with their associated discard disposal facilities are described in the Kleinkopje and Landau Colliery EMPR's respectively.

1.6.5 At full output the mine will produce approximately 750 000 tons per year of steam coal from 1.0 to 1.2 million tons per year of raw coal.

1.6.6 The project's life is between 3 and 4 years.

PART 2: DESCRIPTION OF THE PRE-MINING ENVIRONMENT

2.1 GEOLOGY

2.1.1 Geological description

Throughout the Witbank area a thin succession of Vryheid Formation sediments is present. At their thickest these sediments attain some 120-140 metres and can contain a number of coal seams of which four are considered to have economic potential.

The deposition of the Vryheid Formation sediments is to a great extent controlled by the pre-Karoo platform on which they were deposited. These pre-Karoo rocks, consisting mainly of Waterberg quartzites or outliers of the Bushveld Igneous Complex, have been glacially sculptured giving rise to an even basement topography. A thin veneer of Dwyka sediments overlies the pre-Karoo but is generally not thick enough to ameliorate the irregularities in the glaciated surface which therefore affected the deposition of the younger Karoo sediments.

Figure 2.1 comprises four geological logs of the mini-pit area. The boreholes reflected are Nos. 2634, 2657, 2680, 2720 and their locations are shown on Figure 2.2. Three geological cross sections of the mini-pit are shown on Figure 2.3. The location of the cross-sections is shown on Figure 2.4.

2.1.2 Presence of dykes, sills and faults

The regional geology of the Schoongezicht coal deposit is shown on the 1:250 000 Geological Survey series, Pretoria Sheet, 2528. The coal occurs in the Vryheid Formation of the Ecca Series which overlies a thin layer of Dwyka shales and tillites. The Ecca and Dwyka sediments are deposited in a glacial valley unconformably overlying Waterberg Group quartzite and sandstones. Rare diabase intrusions in the Waterberg have been regionally mapped, but no regional faulting has been detected.

Past opencast and underground mining has shown the presence of dykes.

2.2 CLIMATE

2.2.1 Regional climate

The climate of the area is one of summer rainfall with an average of about 724mm per annum. There is normally one fall annually of over 40mm. The average summer temperature range is from 12 degrees celsius (°C) to 29°C with an average temperature of 20°C. The winter temperature varies from -3°C to 20°C with an average temperature of 9°C, the first frost being experienced in May and the last in August. The prevailing winds are from the northwest with an average speed of 2.9 metres per second.

2.2.2 Mean monthly and annual rainfall

Table 2.2.1 shows the monthly and annual rainfall recorded at the Kromdraai opencast mine since 1982 when records commence.

TABLE 2.2.1 - MONTHLY AND ANNUAL RAINFALL AT KROMDRAAI LIMING PLANT (MM/MONTH AND MM/YEAR)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1982	38	52	132	14	0	0	11	0	4	85	89	30	455
1983	186	36	90	31	15	21	23	38	3	83	251	89	866
1984	131	115	86	7	0	20	15	6	14	112	71	82	659
1985	78	171	89	0	17	0	0	0	49	83	65	94	646
1986	119	66	54	22	0	7	0	1	0	91	195	121	676
1987	143	36	187	17	3	0	0	41	86	65	217	123	918
1988	76	63	52	18	0	12	4	0	6	120	84	97	532
1989	76	151	95	29	11	49	0	5	2	52	179	124	773
1990	39	77	104	89	8	20	4	0	7	34	82	202	666
1991	179	150	194	4	2	28	0	0	6	69	45	97	774
1992	70	100	51	9	0	0	0	1	1	69	88	62	451
1993	73	171	122	45	2	0	0	0	60	172	150	117	912
1994	160	117	66	7	0	0	0	0	8	55	68	90	571
1995	120	49	128	114	8	0	0	6	3	76	183	197	884
1996	212	326	110	72	24	0	3	10	1	130	51	138	1077
1997	61	21	225	28	85								
Average	116	112	104	32	6	10	4	7	17	86	121	111	724

Average excluding 1997.

Table 2.2.2 shows the number of days in each month since 1986 with measurable precipitation.

TABLE 2.2.2 - MONTHLY AND ANNUAL DAYS OF RAINFALL AT KROMDRAAI LIMING PLANT (MM/MONTH AND MM/YEAR)

MONTH	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	AVERAGE
Mar	6	9	15	5	7	9	6	8
Apr	7	7	1	4	2	7	9	5
May	3	3	1	-	-	2	3	2
Jun	4	-	4	-	-	-	-	1
Jul	-	1	-	-	-	-	1	0
Aug	1	-	-	2	-	2	4	1
Sep	1	2	2	1	1	2	1	1
Oct	6	6	5	1	7	8	10	6
Nov	11	11	10	7	10	13	8	10
Dec	12	15	10	10	7	11	11	11
Jan	9	13	11	10	11	8	14	11
Feb	10	9	8	13	6	4	18	10
Total	70	76	67	53	51	66	85	66

2.2.3 Maximum rainfall intensities per month

The storm event figures for both the Kromdraai and Navigation areas have not been recorded. Table 2.2.3 shows the rainfall records available from the Witbank Municipality.

TABLE 2.2.3 - AVERAGE RAINFALL & 24 HOUR STORM EVENTS RECORDED BY WITBANK MUNICIPALITY FOR THE PERIOD MAY 1956 - JANUARY 1992

MONTH	AVERAGE	Max. in 24 hrs (mm)	Max. in 24 hrs Date
Jan	132	76	81.01.23
Feb	83	94	84.02.26
Mar	81	88	91.03.17
Apr	48	66	60.04.23
May	14	30	56.05.10
Jun	9	54	89.06.04
Jul	9	28	57.07.02
Aug	8	24	87.08.25
Sep	30	51	81.09.10
Oct	82	77	58.10.21
Nov	123	61	83.11.20
Dec	104	62	89.12.23

2.2.4 Mean monthly maximum and minimum temperatures

The nearest weather stations at which this data has been recorded are Carolina and Bethal.

These figures are not believed to represent climatic conditions in the Witbank region and have therefore not been included, but will be made available on request.

2.2.5 Mean monthly wind direction and speed

The nearest weather stations at which these data have been recorded are Carolina and Bethal.

These figures are not believed to represent climatic conditions in the Witbank region and have therefore not been included, but will be made available on request.

2.2.6 Mean monthly evaporation

The mean monthly evaporation for Witbank Dam is presented in Table 2.2.4

TABLE 2.2.4 - MEAN MONTHLY EVAPORATION AT WITBANK DAM FOR THE PERIOD MARCH 1963 TO SEPTEMBER 1989 (SYMONS TANK)

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
178	144	136	100	81	68	74	100	136	170	165	174

2.2.7 Incidence of extreme weather conditions

There are no suitable records of extreme weather conditions, however if required these may be extracted from the records of the nearest weather station.

2.3 TOPOGRAPHY

The topography of the area is illustrated on the Government topocadastral sheet 2529CC/Witbank on a scale of 1:50 000.

Figure 2.4 shows in detail the topography of the Schoongezicht mini-pit. The surface lies at between 1570 and 1500 meters above mean sea level and forms part of the watershed between the Schoongezicht and Township spruits.

2.4 SOIL

The soils in the unmined area are typical of the Mpumalanga highveld and are representative of the highveld catena. Well drained red soils grade downslope through yellow and brown soils to hydromorphic soils in the lower slope and bottom lands. Hydromorphic soils are not present within the planned mining area which is situated towards the slope crest. Pre-mining soil types are mapped (SC 51B Supplementary Report No. 1).

Dominant soil forms are Hutton, Cloveley and Avalon, with lesser proportions of Bainsvlei present. The relative abundance of the soil types present is indicated in Table 2.4.1. Pre-mining soil depth is indicated (SC 51C Supplementary Report No. 1.) The soil survey was conducted by Amcoal Environmental Services (AES) and is included as Supplementary Report No. 1.

Table 2.4.1: Distribution of soil types

Soil type	Area (ha)	% of total
Hutton	52.7	33.2
Cloveley	52.2	32.8
Avalon	38.4	24.2
Bainsvlei	15.6	9.8
Total	158.9	100

2.5 PRE-MINING LAND CAPABILITY

The area to be disturbed is 180.4 Ha in extent. Of this area 21.5 Ha is covered by coal discard dumps. Of the remaining area, 119.2 Ha is of arable potential and 39.7 Ha of grazing potential. (Table 2.5.1 and SC 51A Supplementary Report No. 1).

Table 2.5.1: Pre-mining land capability

Land capability	Area	
	hectares	percent of total
Arable	119.2	66
Grazing	39.7	22
Covered by coal discard dumps	21.5	12
Wilderness	zero	0

Of the 119.2 Ha of arable land, approximately 36.9 Ha were disturbed by opencast mining in 1987 to 1990. Both were rehabilitated and 16.9 Ha remains as the existing void.

2.6 PRE-MINING LAND USE

A portion of the area was, at some time, cropped. The northern portion of the planned mining area shows little sign of disturbance although aerial photographs indicate that the area was also cropped in the past. A proportion of the area (21.5 Ha) is occupied by coal discard dumps. Adjacent to the discard dumps the land surface is disrupted by the presence of borrow-pits, pollution containment dams and a poorly vegetated area which was used as a coal stockpile.

The planned mining area is bounded by a railway line to the southeast, the Schoongezicht suburb on the north east, the N-4 highway to the north and the previously mined 4 seam mini-pit to the south.

2.7 NATURAL VEGETATION/PLANT LIFE

Two broad vegetation communities are evident on the planned mining site. A disturbed grassland community impacted by the discard dumps and associated disturbed areas, and a mixed grassland community typical of degraded forms of the eastern variation of Bankenveld. Dominant species within this mixed grassland community are *Heteropogon contortus, Eragrostis racemosa, Hyparrhenia hirta and Microchloa caffra* with the palatable grass *Themeda triandra* less abundant. Species composition reflects past disturbance to the grassland community. Average plant basal cover within this mixed grassland community is approximately 15 percent. The disturbed grassland community adjacent to the discard dumps is dominated by *Hyparrhenia hirta*.

No rare or endangered plant species were located within the planned mining area. Exotic plant species are not abundant, although *Solanum sissimbrifolium* (wild tomato), *Acacia mearnsii* (black wattle), *Eucalyptus sp*. (gum trees) and *Cortaderia jubata* (pampas grass) are present in low numbers. A full list of species identified is included in the vegetation survey report done by AES (Supplementary Report No 2).

2.8 ANIMAL LIFE

On account of the close proximity of the planned mining area to the Schoongezicht suburb of Witbank, animal life is scarce. No evidence of rare, endangered or vulnerable species (Red Data species) were observed on site. Species observed on site are listed in Supplementary Report No 2. Similarly, Red Data species which may occur in the area, based on published distribution maps, are listed and discussed in Supplementary Report No 2.

2.9 SURFACE WATER

2.9.1 Surface water quantity

The mining area lies between the Schoongezicht and Townshipspruit which flow into the Brugspruit as shown on Figure 2.10. These streams form part of the Olifants River catchment, catchment No 210, as shown on Figures 2.10.

A continuous water monitoring station has been installed on the Schoongezichtspruit to measure volume, pH and conductivity. Due to vandalism limited data is available from this station, manual sampling is thus being conducted.

The flow in Klipspruit is measured at a Department of Water Affairs and Forestry weir (B1H005) at Zaaihoek some 40 km downstream of the Mini-pit. The catchment area at Zaaihoek weir was measured from a 1 in 250 000 scale map to be 376 km^2. The Mean Annual Runoff (MAR) was measured at the Zaaihoek weir for the period 1985 to 1995 to be 23.4 million m^3.

The base flow in the Klipspruit is strongly influenced by point discharges from local sewage treatment plants and the Brugspruit Water Pollution Control Works treating the acidic seeps from the old mine workings. With the rapid expansion of the urban areas, the runoff volumes and base flow in the Klipspruit can be expected to increase.

The water surface elevations along the Townshipspruit were determined for the 50 year recurrence interval flood peak. (The flood line is shown plotted on **Figure 4.1(a)** in Supplementary Report No 4).

The catchment area upstream of the pit was measured from 1 in 10 000 scale orthophotos to be 1.4 km^2. The surface runoff from the upstream catchment will be partially intercepted by the railway line which runs in an east-west direction across the catchment almost immediately upslope of the pit. The runoff water will be diverted by the railway line from the pit towards the Townshipspruit (see **Figure 3.2(a)** in Supplementary Report No 4).

2.9.1.2 Dry Weather Flows

The dry weather flow calculated for the Townshipspruit and the Schoongezichtspruit is the natural dry weather flow not taking into account any discharges or seepages into these streams - refer to **Table 3.2 (d)**.

Table 3.2 (d) Dry Weather flows in the Townshipspruit and the Schoongezichtspruit

Stream	Dry Weather Flows (m^3/s)
Townshipspruit	0.0010
Schoongezichtspruit	0.0012

2.9.2 Surface water quality

The Schoongezichtspruit and the Townshipspruit are impacted by numerous coal mining related activities on the Landau Colliery complex and neighbouring mines.

The Department of Water Affairs and Forestry prepared an interim Water Quality Management Plan for the Klipspruit catchment in 1992. A White Paper was tabled in Parliament which outlined the strategy to specifically deal with AMD emanating from old defunct mines in the area. The strategy involved a three-phased approach:

- Phase 1 which focused on more intensive water pollution control at source.
- Phase 2 which incorporated the construction of an acid mine drainage collection and treatment works.
- Phase 3 which involved the re-mining and/or rehabilitation of the mining-impacted areas.

The historical water quality in the Townshipspruit to the east of the Mini-Pit and in the Schoongezichtspruit to the west of the Mini-Pit was analysed. The historical water quality at the Zaaihoek weir was also analysed to give an indication of the baseline water quality in the Klipspruit catchment.

A number of interim and acceptable water quality guidelines were stipulated in the White Paper and these were compared to the historical water quality found in the Townshipspruit, Schoongezichtspruit and at Zaaihoek weir on the lower Klipspruit.

Water quality records collected by South African Coal Estates at two monitoring stations on the Townshipspruit were analysed from January **1990** to establish the baseline situation in this stream **(refer to Figure 3.2(a)** in Supplementary Report No 4 for the location of stations).

- **WP026** - at the point where the Townshipspruit leaves the SACE property.
- **WP027** - at the point where the Townshipspruit enters the SACE property.

The baseline water quality in the Townshipspruit is summarised below in **Table 3.2(c)** and **Table 3.2(d)**.

Table 3.2(c) Baseline Water Quality in the Townshipspruit entering SACE property

Water Quality Variable (mg/l)	Townshipspruit entering SACE (WP027)				White Paper Guidelines	
	5% tile	50% tile	95% tile	Range	Interim	Acceptable
pH	2.3	4.0	6.4	1.9-8.5	6.0-9.0	6.5-8.5
Electrical Conductivity (mS/m)	50	151	378	38-452	120	100
Calcium, Ca	31	200	493	0.0-530	-	-
Magnesium, Mg	0.0	94	284	0.0-286	-	-
Sodium, Na	19	34	48	17-48	250	150
Potassium, K	1.3	5.4	15	0.8-19	-	-
Sulphate, SO_4	221	1687	2888	31-4751	500	250
Chloride, Cl	4	14	65	4-70	320	100
Iron, Fe	0.01	0.85	96	0.0-226	1.0	0.3
Aluminium, Al	0.0	5.7	24	0.0-30	0.2	0.1
Manganese, Mn	5	13	30	5-30	1.0	0.2

(Shaded) Exceeds the Interim Guideline

Table 3.2(d) Baseline Water Quality in the Townshipspruit leaving SACE property

Water Quality Variable (mg/l)	Townshipspruit entering SACE (WP027)				White Paper Guidelines	
	5% tile	50% tile	95% tile	Range	Interim	Acceptable
pH	2.2	4.7	7.1	2.1-7.8	6.0-9.0	6.5-8.5
Electrical Conductivity (mS/m)	39	106	356	20-383	120	100
Calcium, Ca	42	139	460	32-517	-	-
Magnesium, Mg	20	71	234	17-292	-	-
Sodium, Na	22	30	45	20-46	250	150
Potassium, K	0.8	3.7	12	0.5-15	-	-
Sulphate, SO_4	104	1073	2658	61-2695	500	250
Chloride, Cl	6.7	18	50	6-60	320	100
Iron, Fe	0.05	1.6	84	0.01-174	1.0	0.3
Aluminium, Al	0.4	6.4	17	0-20.6	0.2	0.1
Manganese, Mn	2.4	6.5	12	2-14	1.0	0.2

[shaded box] Exceeds the Interim Guideline

The historical sulphate concentration and pH profiles for the Townshipspruit entering and leaving the SACE property are shown graphically on **Figures 3.2(b)** and **3.2(c)** respectively, which are contained in Supplementary Report No 4.

The Townshipspruit water quality is already impacted, by the time it flows onto the SACE property. The water is at times highly acidic and saline. The water quality improves marginally as the spruit flows across the SACE property. The Townshipspruit water quality in general does not meet the salinity-related or the acidity-related water quality guidelines, set for the Klipspruit catchment. A significant deterioration in water quality was noticed during the early months of 1996, after a plug-dam burst at the upslope South Witbank Colliery. This resulted in acid mine drainage entering the stream on a continuous basis.

Water quality records collected by SACE from the Schoongezichtspruit, which is on the western side of the Mini-pit, were also analysed from 1992 to 1996 (refer to Figure 3.2(a) in Supplementary Report No 4 for location of the monitoring point):

The baseline water quality in the Schoongezichtspruit is summarised below in **Table 3.2(e)**.

Table 3.2(e) Baseline Water Quality in the Schoongezichtspruit

Water Quality Variable (mg/l)	Townshipspruit entering SACE (WP027)				White Paper Guidelines	
	5% tile	50% tile	95% tile	Range	Interim	Acceptable
pH	2.5	3.1	3.9	2.0-4.5	6.0-9.0	6.5-8.5
Electrical Conductivity (mS/m)	53	199	368	46-395	120	100
Calcium, Ca	68	220	469	67-492	-	-
Magnesium, Mg	24	83	148	23-151	-	-
Sodium, Na	15	30	43	14-44	250	150
Potassium, K	1.5	3.6	8.0	0.7-8.9	-	-
Sulphate, SO_4	356	1324	1989	315-2080	500	250
Chloride, Cl	5	12	43	4-50	320	100
Iron, Fe	0.9	11	37	0.3-40	1.0	0.3
Aluminium, Al	13	18	27	12-28	0.2	0.1
Manganese, Mn	1.7	6.3	8.6	1.6-9.5	1.0	0.2

[shaded] Exceeds the Interim Guideline

The water quality in the Schoongezichtspruit is also at times very poor. Acidic mine water seeping and decanting from the upslope mine workings at times impacts on the spruit. A collapse of an under-mined area associated with the old Schoongezicht Section took place after the 1995/96 wet summer. This resulted in a continuous flow of acid mine drainage down the stream. The acidity-related (pH, Al, Fe, Mn) and salinity-related (sulphate and conductivity) water quality variables exceed the White Paper interim guidelines.

The Department of Water Affairs and Forestry maintains a flow and water quality monitoring station at Zaaihoek on the Klipspruit. The water quality at this weir was taken as being representative of the baseline water quality of the Klipspruit catchment. The general profile of the historical water quality over the period 1 October 1992 to 30 September 1995 in the Klipspruit at Zaaihoek is summarised in **Table 3.2(f)**.

The impact of upstream polluted streams on the Klipspruit was assessed by comparing the baseline water quality of the Klipspruit with the White Paper guidelines. The main water quality variables of concern at Zaaihoek were found to be pH and sulphates. The water quality, specifically of the acidity-related variables, will improve after commissioning of the Brugspruit Water Pollution Control Works.

Table 3.2(f) Baseline Water Quality in the Klipspruit at Zaaihoek Monitoring weir.

Water Quality Variable (mg/l)	Townshipspruit entering SACE (WP027)			White Paper Guidelines	
	5% tile	50% tile	95% tile	Interim	Acceptable
pH	3.9	6.2	8.0	6.0.9.0	6.5-8.5
Electrical Conductivity (mS/m)	44	74	118	120	100
TDS	285	485	808	820	680
Calcium, Ca	24	42	66	-	-
Magnesium, Mg	12	19	28	-	-
Sodium, Na	39	73	126	250	150
Potassium, K	5	8	12	-	-
Sulphate, SO_4	153	265	512	500	250
Chloride, Cl	23	38	65	320	100
Fluoride, F	0.3	0.5	0.9	1.7	1.0
Ammonia as N	0.02	0.04	0.13	2.0	1.0
Phosphate as P	0.004	0.01	0.02	-	-
Nitrate as N	0.03	0.06	0.8	10	6
Manganese, Mn	-	-	-	1.0	0.2
Iron, Fe	-	-	-	1.0	0.3
Aluminium, Al	-	-	-	0.2	0.1

(shaded) Exceeds the Interim Guideline

2.9.3 Drainage density of area to be disturbed

The drainage densities for the Townshipspruit and the Schoongezichtspruit are presented in **Table 3.2(g)**.

Table 3.2(g) Drainage Densities for the Townshipspruit and the Schoongezichtspruit catchments

Stream	Drainage Length (km)	Surface Area (km^2)	Drainage Density (km/km^2)
Townshipspruit	2.15	8.7	0.25
Schoongezichtspruit	2.9	11.3	0.26

2.9.4 Surface water use

The Schoongezichtspruit and Townshipspruit flow into the Brugspruit which flows into the Klipspruit. The two water users in this catchment are informal domestic use and aquatic life.

The Klipspruit flows through the informal settlement of Kwa-Guqa which is on the outskirts of Witbank. This informal settlement has a ready supply of potable water in the form of stand-pipes. The Klipspruit is therefore mainly used for domestic purposes in the form of clothes washing and cleaning. Cropping within the Klipspruit catchment is mainly dryland as irrigation using the stream water has ceased due to the poor water quality. The poor water quality has also had an effect on the aquatic life of this catchment with stretches of stream becoming devoid of the expected aquatic life (IWQS, 1996).

2.9.5 Water authority

The water authority for the area of mining is the Department of Water Affairs and Forestry.

2.9.6 Wetlands

No wetland exists on the area to be mined, however a vlei area exists in the Schoongezichtspruit north of the N4 motorway. The mining plan will not encroach into the 1 in 50 year flood line level of the Townshipspruit.

2.10 GROUND WATER

2.10.1 Depth of water tables

Previous experience in the area indicates that the regional piezometric surface is topographically controlled with groundwater draining towards the surface stream channels. Locally, dewatering associated with existing and abandoned underground mine workings can lower the piezometric surface to the discharge elevation of the workings.

Six boreholes were drilled around the Mini-Pit to obtain geohydrological information. Water levels recorded in four of the boreholes are presented in **Table 3.3.1**. No other groundwater level data are available beyond the discharge elevation of the Schoongezicht underground workings - approximately 1480 m above msl.

Table 3.3.1 : Measured groundwater levels

Borehole	Collar elevation (amsl)	Water table elevation (amsl)
EMP 02	1 504.4	1496
EMP 04	1 532.7	1523
EMP 05	1 525.7	1510
EMP 06	1 522.5	1515

The following aquifer types may be inferred from the geology of the area:

Shallow, perched aquifer: This shallow (± 10 m) aquifer is essentially independent of the underlying geology and is found perched within the permeable and very highly weathered residual sandstone above the residual sandstone-bedrock interface.

Drilling results indicate the presence of a very shallow (± 2 m) pedogenic ferricrete horizon which may allow a perched water body to develop locally. However, this water body is not significant with respect to groundwater flow around the Mini-Pit.

Experience of Karoo geohydrology indicates that recharge to the shallow groundwater aquifer is relatively high, up to 3 per cent of Mean Annual Precipitation (MAP). The porosity of the sediments is estimated to be in the order of 40 percent, resulting in a high storativity. Permeability values can vary considerably, depending on the nature of the overburden material, but values of 10^{-4} to 10^{-8} m/s are typical.

Fractured Karoo Rock aquifer: Extractable groundwater held within the sandstones and shales is usually associated with water-bearing fractures within the rocks or the fractured contacts adjacent to intrusive dykes or sills. Overall, the groundwater potential of these aquifers is moderate to low.

Recharge to the deeper fractured rock aquifer is estimated to be in the order of 1 per cent of the Mean Annual Precipitation (MAP). The porosity of the Vryheid formation in the Karoo Sequence typically ranges from 5 to 15 per cent. However, the specific retention of the interstitial water in Karoo sandstones and shales is high, resulting in a low yield. Typically, only approximately 10 per cent of the interstitial water is released. Permeability values range from 10^{-6} to 10^{-8} m/s.

Aquifers associated with dolerite intrusives: Groundwater commonly occurs within the upper portion of weathered and jointed dolerite sills or the fractured margins of dolerite dykes. No significant dolerite intrusives have been noted at the No 2 Seam Mini-Pit.

Aquifer associated with coal seams: The margins of coal seams or clastic partings within coal seams are often associated with groundwater. The coal itself tends to act as an aquitard allowing the flow of groundwater at the margins. The groundwater potential for such aquifers is generally regarded as low.

Permeability values along the coal seams range from 10^{-6} to 10^{-8} m/s. There is generally a microstructure associated with the coal seam which gives it a relatively higher permeability than the adjacent sediments. The exploitability of the groundwater may be regarded as moderate to low.

2.10.2 Water boreholes and springs

No water boreholes are present on the mining area.

2.10.3 Ground-water quality

No analyses of groundwater quality in the vicinity of the Mini-Pit are available. Monitoring boreholes have been drilled recently (mid-March 1997). The boreholes have been used for permeability testing and water of different quality was pumped into the boreholes. After a suitable period to allow the "foreign" water to be displaced (approximately 2 weeks), groundwater in the boreholes will be sampled for chemical analysis. The results of the analyses will provide an indication of the current groundwater quality around the Mini-Pit.

2.10.4 Ground-water use

Land use in the vicinity of the Mini-Pit is devoted exclusively to mining, with the exception of urban development associated with Witbank and the national highway to the north and northeast. Consequently, no groundwater users have been identified within a 3 km radius of the Mini-Pit.

2.10.5 Ground-water zone

The preceding sections demonstrate the geohydrological interaction between the neighbouring mines and the proposed Mini-Pit. It is not pragmatic to consider the zone of influence of any one mine or a section of a mine in isolation. The extent and quantification of the affected groundwater zone of the Schoongezicht No 2 seam Mini-Pit should be undertaken on a regional scale incorporating the surrounding mines.

2.10.6 River diversion

No river or streams will be diverted.

2.11 AIR QUALITY

Monitoring

An air quality monitoring programme has been implemented for Landau Colliery. Sufficient data was available from existing data to allow environmental consultants, Annergarn Environmental Consultants, to prepare a full air quality report. Supplementary report no. 5.

Two twin directional dust sampling buckets have been installed at:

Mpondozankomo Technical College at the Caretakers residence.
No. 10 Overmeyer street, Schoongezicht township, resident: Mrs Patricia Davids.

Three uni-directional dust sampling buckets have also been installed. The position of all 5 buckets are indicated on figure 1.

Existing Air Quality

The Witbank/Middelburg area of the Mpumalanga Highveld is a region of major coal mining, heavy metallurgical industries and power generation. The emissions from these activities, aggravated by unfavourable climatic dispersion, has resulted in poor air quality over the whole region. This is manifested specifically in high particle concentrations and poor visibility. Locally there may be high concentrations of SO_2 gas, from burning coal discards, although this situation has improved dramatically in recent years. Emissions from domestic coal burning may result in localised areas of very poor visibility (< 20 m) during early mornings and evenings, and high particle exposures of the residents.

Contributions of wind blown, mechanically generated and detonation dust have not been quantified on a regional basis. Localised visual observations have recorded heavy emissions of dust from coal stockpiles, spoil piles, ash dams and, seasonally, from ploughed agricultural land. Continuous operations like draglining and movement of mine haul trucks on unpaved roads, have been identified as significant generators of crustal dust. Intermittent overburden and coal blasting generate plumes which are highly visible, but of short duration. Quantitatively, the amount of dust contributed by blasting is small compared to potential dust emissions from other continuous mining activities. Collectively, these sources are classified as fugitive sources of dispersed dust.

The size distribution of particles in fugitive dispersed dust is continuous, with a mean size dependent on the generating process and the time since material became airborne. Once airborne, larger particles (sand and grit >200 μm diameter) will settle out very rapidly, except in extremely turbulent wind. During blasting, particles of this size may be considered part of the flyrock, and protection is provided against impacts by regulations concerning blasting safety.

Settleable particles, in the range $30 < d < 200$ μm, separate from the air stream fairly rapidly under gravity, and have measurable dust deposition rates up to -2 km from source, depending on wind speed and height of ejection. This component of the dust size spectrum is the most likely to cause short term nuisance in the form of soiling, mechanical damage, or physical irritation of eyes and respiratory tracts.

Suspended particles, with $d < 30$ μm, are likely to be transported many kilometres, and have mean atmospheric residence times of minutes to hours. Particles at the lower end of this size fraction can be inhaled, and are of concern from a respiratory health viewpoint. The lower end of this size range can be taken for practical purposes as d - 1 μm.

Historically, the Witbank district was predominantly a maize cultivation area. Soil cultivation itself has led to large exposed areas of soil on a seasonal basis, and both ploughing and harvesting, and burning of agricultural residues, are dust and fume producing activities.

The expansion of surface mining operations in the Mpumalanga Highveld over the two past decades have added considerable additional sources of fugitive dispersed dust; new areas of exposed material; additional dragline, front-end loader and scraper material handling; and haul truck vehicle traffic on unpaved roads. These activities contribute to near-surface deterioration of air quality.

However, several years of experience in monitoring fallout dust on coal mines on the Mpumalanga have shown that measurable fallout from surface mining operations is restricted to a 1 km zone from source, provided standard engineering practices are followed for dust mitigation. The sources most likely to result in heavy dustfall rates are:

- Haul truck operations on unpaved roads on surface (i.e. outside the pit confines)
- Untreated or unrehabilitated coal discards - wind erosion and truck operations
- Unshielded continuous conveyor transfer points.

For practical purposes then, evaluation of impacts of dust from surface mining may be focused on zones within 1 km of the mine boundaries, and corridors of 500m to 1 km on either side of public roads used by mine haul trucks. (The broader provision of the EMPR guidelines for a 3 km zone for fallout dust, is more relevant to gold mine slime tailings which are elevated up to 50 m above the surrounding topography).

The continuous size range of dispersed dust at the point of emission has relevance to monitoring and control. If fallout dust is monitored and controlled, then simultaneously suspended dust be mitigated. Except in the case of severe dust emissions, in urban residential environments, or for very extensive operations, it is not necessary to monitor separately the suspended dust fraction.

2.12 NOISE

The Schoongezicht Suburb is at present subjected to noises from:

- Spoornet's Witbank/Pretoria line.
- The N4 highway.
- Ferrometals steelworks.

Present noise level emissions from these sources have not been measured. Due to the pit's life being very short, less than 4 years, we do not plan to carry out a noise impact study. Air-over pressure readings, in dB, will be recorded as an integral part of the blast vibration monitoring and reported monthly to the Regional Department of Mineral and Energy Affairs.

2.13 SITES OF ARCHAEOLOGICAL AND CULTURAL INTEREST

The proposed area was walked by staff of Amcoal Environmental Services during completion of vegetation and wildlife surveys. No graves, old buildings of historical or cultural interest or iron age sites were identified.

2.14 SENSITIVE LANDSCAPES

At present there are no sensitive landscapes. On completion of the project the land will be returned to the Witbank Transitional Local Council in a condition so as to facilitate development by Witbank Transitional Local Council.

2.15 VISUAL ASPECTS

The pit is visible from the public roads and as a result will be noticeable from the public highway. The ROM tip position has been specifically placed behind the existing topsoil stockpiles and away from the residential area. However, the area will be rehabilitated on completion of mining and returned to the Witbank Transitional Local Council.

2.16 REGIONAL SOCIO-ECONOMIC STRUCTURE

This is reported on in the Landau Colliery EMPR.

The mini-pit will continue to provide employment for some 250 people with plant and infrastructure providing employment for a further 100 people.

2.17 INTERESTED AND AFFECTED PARTIES

The residents of the Schoongezicht township have been consulted and a Schoongezicht Residents Council has been instituted. Full minutes of all meetings held with interested and affected parties are included as Supplementary Report No. 3. An educational visit by 50 Standard 6 pupils of Witbank Primêre Skool was held on Tuesday, 25th March. An invitation has also been extended to staff and students of Mpondozankomo Technical College. An information session with the elderly residents was held at the Schoongezicht Clinic on Tuesday, 20th May 1997.

A full pre-mining house survey in the Schoongezicht Township has been completed by blasting consultants, Mining Resources Engineering Limited (MREL). The house survey files have been examined by the Department of Mineral and Energy Affairs. The originals are held at Landau Colliery, Navigation Offices and are open for examination on request. MREL have continued house surveys on an ongoing basis. Three permanent vibration and air overpressure monitoring points have been established. They are situated at:

1) 10 Overmeyer Street, Schoongezicht Township.
2) 203 Jefferys Street, Schoongezicht Township.
3) At a position ± 50 metres south of the R103, north of the Run-of-Mine tip, north of the topsoil stockpiles.

Witbank Transitional Local Council has also been consulted. Minutes of all meetings held are also included in Supplementary Report No. 3.

Spoornet, Eskom, Mpumalanga Government, Department of Transport and the Department of Water Affairs and Forestry have been consulted and their permissions obtained to carry out mining activities adjacent to areas of concern under their jurisdiction. Copies of all permissions are contained in Supplementary Report No. 3.

PART 3: MOTIVATION FOR THE PROJECT

3.1 BENEFITS OF THE PROJECT

The project will place 750 000 tons per year of steam coal onto the export market which will earn foreign exchange for the country.

As the project will utilise existing plant capacity at Klipfontein and Navigation, capital expenditure will be minimal. It is estimated that less than R3.0 million will be spent.

There will be no decrease in the labour employed. Labour will be transferred from Schoongezicht No 4 Seam pit to the No 2 Seam pit. There will be no change in labour employed in the Klipfontein plant.

The land is owned jointly by Witbank Transitional Local Council and Landau Colliery and a mining permit is held by Landau Colliery for the portion of ground owned by the municipality. At present it is clearly visible that mining has taken place in the vicinity, initially by underground methods, which has left dumps in the vicinity and more recently by opencast methods, which has left a highwall and final void. After completion of rehabilitation, the area should be more visually acceptable than it is pre-mining.

Through consultation with the Witbank Transitional Local Council it is planned to rehabilitate the land for township development.

PART 4: DETAILED DESCRIPTION OF THE PROJECT

4.1 SURFACE INFRASTRUCTURE

No permanent surface infrastructure will be constructed. The contractor will set up a site office, workshop and primary crushing plant which will be removed on completion of mining.

Use will be made of Landau and Kleinkopje Collieries' plant and infrastructure which are described in their respective EMPR's.

4.1.1 Roads, railways and powerlines

The major infrastructure network is shown on Figure 1.4.

4.1.2 Solid waste management facilities

Industrial and domestic waste facilities are described in the Landau Colliery EMPR.

Mine residue will be disposed of at the Navigation plant Blaauwkrans disposal site and the Klipfontein plant disposal site. These sites are described respectively in the Landau Colliery and Kleinkopje Colliery EMPR's.

4.1.3 Water pollution management facilities

Use will be made of the Navigation sewage plant which is described in the Landau Colliery EMPR.

Pollution for the mini-pit will link into the system described in the Landau Colliery EMPR which is shown on Figure 2.12.

A detailed water balance was done by Wates, Meiring and Barnard (Supplementary Report 4).

As the mini-pit will not encroach on the 1-50 year flood level line of either the Township or Schoongezichtspruit there will be no risk of flooding.

4.1.4 Potable water

Potable water will be obtained from the Witbank Municipality.

4.1.5 Process water

Water for dust suppression in the pit will be obtained from the Pit dirty water system. Water for dust suppression at the crusher will be obtained from the mining complex dirty water system shown in figure 4.5.

4.1.6 Mineral processing plant

Raw coal from the mini-pit will be processed at the Navigation and Klipfontein plants which are shown on Figure 4.2. It is also proposed to truck No 1

Seam coal to South African Coal Estates, Rapid Loading Terminal for direct loading onto trains to Richards Bay.

4.1.7 Workshops, administration and other buildings

No permanent buildings will be erected.

4.1.8 Housing, recreation

Employees will utilise the existing facilities of SACE.

4.1.9 Transport

The coal road hauling routes are shown on Figure 4.2. Coal will be road hauled by contractor vehicles from the mini-pit to the Klipfontein and Navigation plants and the Rapid Loading Terminal along these routes.

4.1.10 Water balance diagram

A detailed water balance was done by Wates, Meiring and Barnard (Supplementary Report 4, Section 4).

4.1.11 Disturbance of water courses

Mining will be limited to outside of the 1-50 year flood line thus leaving the Townshipspruit and Schoongezichtspruit intact.

4.1.12 Storm-water

Storm-water diversion channels will be constructed along the perimeters of the mini-pit. This will reduce infiltration into the spoils and maximise clean water flow into the clean water system.

4.2 CONSTRUCTION PHASE

The construction phase will take some 2 months with the following activities:

- Geological drilling programme and technical investigations.
- Establish pollution control measures.
- Develop boxcut.
- Erect temporary crushing plant.

4.3 OPERATIONAL PHASE

4.3.1 Soil utilisation guide

A soil inventory was completed in 1987. An additional soil sampling programme was done by the Surface Rehabilitation Section of Amcoal Research and Development (Supplementary report No. 1).

4.3.2 Mine surface layout

The mine surface layout is shown in figure 4.5.

Structures that may be affected by blasting are:

- Spoornet railway line.
- N4 Witbank to Pretoria highway
- Houses in the Schoongezicht suburb.

The location of these are shown on Figure 1.4.

Figure 4.3 shows the mining plan. The mining sequence will be from north to south. No final voids will be left, full rehabilitation will take place. The post mining topography is shown on Figure 4.4.

4.3.3 Mineral processing

The mineral processing plants are described in the Landau Colliery and Kleinkopje Colliery EMPR's.

4.3.4 Plant residue disposal

Plant residues from the mini-pit will be disposed of at the Blaauwkrans and Klipfontein discard sites which are described in the Landau Colliery and Kleinkopje Colliery EMPR's.

4.3.5 Transport

The raw coal transport routes are shown on Figure 4.2

4.3.6 River diversion

The Townshipspruit will not be diverted.

PART 5: ENVIRONMENTAL IMPACT ASSESSMENT

5.1 CONSTRUCTION PHASE

Impacts pertinent to the construction phase are covered in Section 4.2.

5.2 OPERATIONAL PHASE

5.2.1 Geology

The geological sequence to the base of the No. 1 seam will be totally disturbed in the mining operation.

Acid/base accounting (ABA) tests were conducted on samples from three borehole cores taken from the proposed Mini-Pit area. A total of ten samples were taken from three boreholes. The existing mined box cut at Schoongezicht may potentially be filled using discard material. Ten ABA samples were also taken from the two discard piles on the site to determine if this material could be utilised as pit fill.

The acid/base accounting test measures the acid potential (AP) and neutralisation potential (NP) of a geological sample in units of kg $CaCO_3$/ton. This allows direct comparison of the NP and AP values and the ratio NP/AP.

Based on a stoichiometric relationship, a NP/AP value of 2 would be required to neutralise acidity at elevated carbon dioxide (CO_2) pressures such as would exist below a spoils surface. An NP/AP ratio of 1 would be required to neutralise acidity in a mine water system open to the atmosphere. Open pit spoils exist within these two extremes.

Long term acidification of opencast pit spoils is indicated as follows:

- $NP/AP < 1$ - Spoils are potentially nett acid generating.
- $3 > NP/AP > 1$ - Uncertainty exists as to long term acidity of the spoils and further kinetic testing is required.
- $NP/AP > 3$ - Spoils are potentially acid consuming.

The range of uncertainty in the above criteria is mainly due top variability in local spoils characteristics, environmental conditions (O_2, CO_2, moisture, etc.) in the spoils, kinetic constraints on the oxidation and neutralisation reactions, etc.

The acid/base accounting results from the borehole cores and discard piles are summarised in **Table 4.2(a)**.

Table 4.2(a): Acid/base accounting results fro exploration borehole and discard samples from the Schoongezicht No 2 Seam Mini-Pit

Sample	Material	AP (kg $CaCO_3$/ton)	NP (kg $CaCO_3$/ton)	NP/AP	Conclusion
SCH01	discard	30.3	2.33	0.08	Acidic
SCH02	discard	92.7	49.4	0.53	Acidic
SCH03	discard	82.7	8.9	0.11	Acidic
SCH04	discard	50.6	-5.27	-0.10	Acidic
SCH05	discard	57.7	15.9	0.28	Acidic
SCH06	discard	25.3	-16.2	-0.64	Acidic
SCH07	discard	33.4	-2.8	-0.08	Acidic
SCH08	discard	13.7	-2.16	-0.16	Acidic
SCH09	discard	29	-4.71	-0.16	Acidic
SCH10	discard	112	-11.7	-0.10	Acidic
S2627/01	carbonaceous shale	2.65	2.02	0.76	Acidic
S2627/02	carbonaceous shale	3.75	17	4.53	Neutral
S2627/03	pyritic sandstone / siltstone	0.78	1	1.28	Uncertain
S2667/01	pyritic siltstone	12.2	185	15.16	Neutral
S2667/02	carbonaceous shale	2.84	2.5	0.88	Acidic
S2667/03	pyritic sandstone	1.12	1.1	0.98	Acidic
S2667/04	carbonaceous shale	4.06	2.47	0.61	Acidic
S2721/01	pyritic siltstone	1.75	1.26	0.72	Acidic
S2721/02	pyritic siltstone	3.43	4.52	1.32	Uncertain
S2721/03	pyritic sandstone	5.62	2.51	0.45	Acidic

The acid generation potential of the discard material is approximately an order of magnitude higher than the samples taken from the exploration boreholes (future spoils material). The spoils material is already generally acid-generating by nature, and this will be substantially enhanced by the introduction of discard material into the pit spoils.

The total volume of discard material is estimated to be 975 000 m^3, while the total estimated volume of spoils generated in the Schoongezicht No 2 Seam Mini-Pit will be 7.2 million m^3. The volume of highly acidic spoils is therefore substantial and the introduction of this material into the pit will definitely have an impact on the pit water quality. It is therefore not recommended to place the discard material in the Mini-Pit, unless it can be placed and immediately submerged after mining of the pit.

5.2.2 Topography

The post-mining topography is shown on Figure 4.4 and is not very different from the original surface. Pit limits will be sloped to blend the unmined and mined surfaces to facilitate surface water flow and township development.

5.2.3 Soils

All usable soil material will be recovered ahead of mining for re-use in the rehabilitation process. The impact on soils in the short run, therefore, will be insignificant.

5.2.4 Land capability

Due to limited availability of soil in relation to the total area disturbed soil replacement will not permit the re-establishment of the same areas of arable land, post-mining as existed pre-mining. It is proposed to replace an average 400 mm of soil, which will ensure that the area has good grazing land capability.

5.2.5 Land use

Currently the land is not utilised and is not available for township development.

5.2.6 Natural vegetation

Natural vegetation will be disturbed during the operational phase. See Supplementary Report No. 2.

5.2.7 Animal life

Animal life will be disturbed during the operational phase. See Supplementary Report No. 2.

5.2.8 Surface water

The historical rainfall record at the Witbank rain gauge was analysed to identify periods of dry, wet and average hydrological cycles. A 58 month moving average of rainfall was used to identify these cycles and simulations were conducted for the following three rainfall scenario's"

- **Worst case scenario**

A wet hydrological cycle (1 April 1986 to 31 January 1991) was used. The total depth of rain over the 58 month period was 3959 mm.

- **Probable scenario**

An average hydrological cycle (1 April 1972 to 31 January 1977) was used. The total depth of rain over the 58 month period was 3491 mm.

- **Best case scenario**

A dry hydrological cycle (1 April 1991 to 31 January 1996) was used. The total depth of rain over the 58 month period was 2623 mm.

The three rainfall scenario's were simulated to demonstrate the range of probable water volumes that may be generated during the mining operation. These are summarised in Table 4.3(a) in terms of average monthly values for the different status types of the mining blocks. These averages are for the full 58 month period. The anticipated maximum monthly pump rates for each scenario are given in Table 4.3(b).

The pit water generation is clearly seasonal and increases substantially in summer. Pit water generation in general will increase as mining progresses due to the increasing size of land disturbed in the process.

The amount of pit water generated is substantial and this water will have to be accommodated in the existing Landau Colliery water circuits.

Dewatering pumps will have to be sized to cater for the peak pit water generation rates. This may require further pit water modelling on a daily time-step.

Should regional maximum floods occur, excess water in the pit will be pumped to the Navigation dirty water control system and used in the Navigation Plant. Storm-water ingress into the pit will be limited by the storm-water drains.

Table 4.3(a) Anticipated average water generation (m^3/month) during active Mini-Pit mining

Water Element	Worst Case Scenario (Wet Cycle)	Probable Scenario (Medium Cycle)	Best Case Scenario (Dry Cycle)
	Average (m^3/month)	Average (m^3/month)	Average (m^3/month)
Recharge flows			
Rehabilitated spoils recharge (400 mm topsoil & vegetation)	1740	1641	1074
Topsoiled spoils (400 mm)	1669	1568	1003
Levelled Spoils	175	162	101
Unrehabilitated Spoils	2286	1979	1314
Sub-Total	5870	5350	3492
Groundwater flows	2420	2420	2420
Runoff flows			
Rehabilitated spoils	3124	1410	1588
Topsoiled spoils	585	750	740
Levelled spoils	56	60	39
Unrehabilitated spoils	623	707	184
Pre-stripped area			
Pit floor	62	51	11
Upslope catchment	4746	4218	2865
	1364	842	346
Sub-Total	10 560	8 038	5773
Total	18 850	15 808	11 685

Table 4.3(b) Mini-Pit water production for different hydrological scenarios

	Best Case Scenario	Probable Scenario	Worst Case Scenario
Water Production			
Average annual pit water make (m^3/year)	92 001	132 244	145 544
Peak monthly pump rate (m^3/month)	22 030	43 686	40 198

5.2.9 Ground-water

During mining, operations at Schoongezicht No 2 seam Mini-Pit will impact on the groundwater aquifers and will substantially modify the existing geohydrological condition.

The groundwater model predicts that the most significant impact during mining will be the dewatering of the surrounding area. The area of influence of this drawdown is limited to within 300m to 500m of the pit perimeter. This effect will be superimposed on the existing dewatering due to the old mine workings to the west and south of the Mini-Pit. The water level in the old workings is estimated to be at an elevation of 1480 amsl, which is below the floor of the Mini-Pit. The effect of dewatering by the pit will thus have a negligible impact on the existing dewatering due to the old mine workings. Due to the absence of groundwater users in the area, this impact is not regarded as significant.

As pit workings will be kept essentially dry, there will be little seepage of polluted water from the workings to adjacent aquifers.

As the run-of-mine from the Mini-Pit will be taken to the Navigation Coal Plant, there will be no discard dumps or slurry ponds on site. There will thus be no impacts on groundwater quality from such pollution sources.

5.2.10 Air quality

Impact on air quality for the mini-pit will be minimal as strict dust allaying procedures will be adhered to. See Supplementary Report No. 5. The monitoring system will cater for additional dust sampling buckets to be installed.

5.2.11 Noise

Discussions have taken place with the Schoongezicht Township Residents Council and the mine has presented their noise allaying plans to the Schoongezicht Residents which have been favourably received.

Limits have also been prescribed by the Department of Minerals and Energy Affairs. Blasting tests were conducted in November and December 1996. The results of these tests were evaluated by Dr W A Crosby of Mining Resources Engineering Limited (MREL). A copy of the resultant report "The Schoongezicht Mini-Pit (Blasting within 500m of Surface Structures)", was handed to the DMEA in an application to update the existing blasting permission. Another copy is included as Supplementary Report No. 6.

Supplementary Report No. 3 contains full transcripts of meetings held with the Schoongezicht Residents.

Blasting operations have commenced and all air overpressure readings have been within the aforementioned limits. No complaints have been received to date. Ongoing contact has been maintained with the residents for this specific reason and to re-introduce mining operations to the residents in an informative and efficient manner.

5.2.12/14 Archaeological, cultural, sensitive landscapes, visual

No impacts on these have been identified.

5.2.15 Regional socio-economic structure

The impact will be positive in terms of continued employment and earning of foreign exchange for the country. The rehabilitation of the mining area will be completed and land returned to the Witbank Transitional Local Council for township development.

5.2.16 Interested and affected parties

The parties affected have been described in Section 2.17.

5.3 DE-COMMISSIONING PHASE

During the decommissioning phase mining operations will cease and rehabilitation of the surface will be completed. Temporary structures will be removed and the surface area rehabilitated.

The pollution control facilities for managing affected water will have been put into place during the operational phase.

5.4 WATER-RELATED IMPACTS DURING THE POST-MINING SITUATION

5.4.1 Surface Water

The effect of the Mini-Pit on the catchment yield after mining will be insignificant. The post-mining surface topography will be free draining (See **Figure 4.4**). The surface runoff will be collected along a drainage line running east-west to the northern boundary of the rehabilitated pit. This surface water will be returned to the Schoongezichtspruit and the Townshipspruit.

The catchment area upslope of the rehabilitated pit is about 30 Ha. The runoff from this area will run across the rehabilitated pit to the drainage line on the northern pit boundary. This runoff will have the following impacts on the rehabilitated pit.

- Increase recharge and hence production of polluted decant water from the pit.

- Increase the erosion potential along drainage lines before the vegetation cover has had time to establish.
- The east-west drainage line discharges at the decant point in the north-west corner of the pit. The surface runoff could become contaminated by the seepage water from the pit decant.
- Possible contamination of the upstream surface water while passing over the rehabilitated pit.

It is therefore proposed to permanently divert the upslope stormwater runoff around the rehabilitated pit. A post-mining analysis of the pit water balance showed that the pit will decant between 12 and 18 years after mining has ceased.

The decant flow from the pit after closure was determined using the entire 480 months of rainfall record available. The 25, 50 and 95 percentile estimated monthly decant flow volumes from the rehabilitated pit are given in **Table 4.4(a)**

Table 4.4(a) Estimated monthly decant flow volumes from the rehabilitated pit

Percentile	Decant Volume (m^3/month)
25	0
50	4 013
75	8 643
95	12 491

The small size of the post-mining decant flow, if allowed to take place, is a candidate for a passive treatment system. (See Supplementary Report No. 4).

5.4.2 Groundwater

The anticipated post-mining impacts are as follows:

- Long-term impact on groundwater quality of polluted decant from the Mini-Pit.
- Long-term impact on groundwater distribution caused by modification of natural hydraulic properties around and within the Mini-Pit.

Polluted water decanting from the pit into the shallow subsurface and surface will report to the Brugspruit and result in a deterioration in water quality. This impact will contribute to the already high pollution load experienced in this water course and the impact is rated as significant.

Replacing the native sandstone, shale and coal with pit spoils subsequent to mining results in a change in the geohydrological properties of the Mini-Pit. In general, the storage and permeability of the pit area will be increased. This will have the effect of flattening the piezometric surface around the pit perimeter and steepening of the groundwater surface just upstream of the pit. Both of these effects are limited to a small area and the absence of groundwater users implies that this impact is not significant. (See Supplementary Report No. 4).

PART 6: ENVIRONMENTAL MANAGEMENT PROGRAMME

6.1 CONSTRUCTION PHASE

The construction phase will be very short and merge with the operational phase. As such management of all environmental impacts are discussed under the Operational Phase.

6.2 OPERATIONAL PHASE

The opencast mining method to be employed is described hereunder and may be modified as circumstances change.

The opencast mining method to be employed will be by bowl scrapers, shovels and trucks and small crawler draglines. The operational steps are as follows:

1. Useable topsoil will be removed and either stockpiled separately for later use during rehabilitation, or placed directly over graded spoils.

2. The overburden to top of coal will be either dozed over into the void left after removal of the coal or loaded into trucks, hauled and dumped into the void. The dumped and/or dozed spoils will be graded to conform with the post-mining required surface profile.

3. Strips of exposed coal between 35 and 50 metres wide will be removed by shovel and truck and hauled to the ROM tip for crushing to minus 75mm.

4. Soil placement, after profiling of the spoils, will be controlled to achieve a planned soil distribution to conform with the land capability plan. After replacement, all profiled surfaces will be thoroughly ripped to overcome compaction of the soil induced by heavy earthmoving equipment. Final tillage will produce a bed suitable for planting pasture seed.

   The pasture performance, fertiliser requirements, success of seed mixes and any other factors which affect growth will be monitored by the land rehabilitation section of Amcoal Environmental Services (AES).

5. Final voids will be filled, sloped for drainage and re-vegetated on completion of the two mining blocks.

A post mining soil distribution plan and land capability plan is attached. See figure 4.6.

6.2.1 Geology

It will not be possible to reinstate the pre-mining geological sequence. Post-mining surfaces will be profiled to facilitate surface water run-off as well as reduce ingress of water into the spoils.

6.2.2 Topography

The indicative post mining topography plan is included as Figure 4.4.
The objective is to rehabilitate the topography so that none of the slopes have gradients that will exceed 12° (12%) and the surface run-off from the rehabilitated area is maximised.

6.2.3 Soils

It is planned to remove, where available, the usable topsoil and subsoils ahead of overburden removal. Sufficient soil will be placed to achieve, as far as practical, areas with grazing potential by placing a minimum of 250mm of soil.

6.2.4 Land capability

The objective of rehabilitation is to restore, as far as practicable, previous land use capability. Where this cannot be achieved the objective is to create stable productive grazing land with minimum input requirements.

6.2.5 Land use

During the operational phase the land ahead of mining will lie fallow. Rehabilitation of mined land will follow the mining window with land being returned to grazing land. Post-mining land use may be for township development once the land is returned to the Witbank Transitional Local Council.

6.2.6 Vegetation

In summary, the aims of revegetation, as stated in the Chamber of Mines guidelines, and to which the mine commits itself are:

- to stabilise the soil and minimise erosion.
- to prevent pollution of streams and air by particulate matter.
- to re-establish nutrient recycling.

Rehabilitation and farming techniques have been developed at all of Amcoal's operations to cope with a large variety of soil types, depths and vegetation. Amcoal is therefore well placed to guarantee a high standard of rehabilitation.

In terms of pastoral product the rehabilitated areas will have the ability to produce at least as much excellent veld as existed before mining to maintain ecological stability even after the application of fertiliser has been terminated.

The natural vegetation, which consists mainly of grasses, will be disturbed and replaced by a seed mix developed by Amcoal. in this regard suitable seed mixes normally in use on Amcoal collieries, and which would be in use in this instance, are the result of numerous trials, experience and advice from specialist consultants. The fertiliser requirements will be determined by periodic routine analyses of the soil. However, if necessary and pending the availability of suitable water, supplementary irrigation may be provided to establish grass cover.

A typical seed mixture currently used by Landau Colliery is presented in Table 6.2.1. It is possible that this mixture will be modified with time as more experience is gained. The aim will be to establish environmental systems which will, as far as is practicable, be self-sustaining.

TABLE 6.2.1 LANDAU COLLIERY REHABILITATION SEED MIXTURE

GRASS TYPE	%	kg/ha
Rhodes	33%	6
Smuts finger	33%	6
Teff	22%	4
Lucerne	12%	2

The above mix treats Teff as a nurse crop. In the first year good cover and therefore erosion control is provided by the fast germination characteristics of the grass. In subsequent years percentages of Teff reduce to virtually zero as the other three species take over.

6.2.7 Animal life

Amcoal does not plan to implement a specific wildlife introduction programme. After mining a natural migration of animal and bird life from adjacent areas onto the rehabilitated opencast area will take place.

6.2.8 Surface water

6.2.8.1 Water balance

A detailed water balance done by Wates, Meiring and Barnard can be seen in Supplementary Report No. 4.

6.2.8.2 Storm-water

The accepted best management guidelines related to the management of upslope stormwater, need to be implemented in the Mini-Pit operation. This will require the construction and maintenance of upslope stormwater diversion berms which are adequately sized to divert the 1 in 10 year storm. The upslope stormwater diversion berms will have to be relocated and reconstructed on an annual basis to restrict the size of the area from which runoff can enter the opencast pit workings via the high wall. It is proposed to construct new upslope stormwater diversion berms on an annual basis, just before the start of the rainy season. The stormwater will be diverted to the Townshipspruit and to the Schoongezichtspruit.

In general, the drainage of stormwater towards the pit should be minimised by minimising stormwater runoff from the access roads and ramp to the pit. The rehabilitated part of the pit will also be shaped to drain away from the mine workings.

In the event of excessive rain, exceeding the 1 in 10 year recurrence interval, large volumes of water will accumulate in the pit floor. The risk of interrupting mining operations therefore exists and emergency and standby pumping equipment must be available on the Landau Colliery Complex to deal with these situations.

Permission should also be obtained from the Department of Water Affairs and Forestry to release the excess pit water during flood events, if it complies to the interim water quality guidelines developed for the Klipspruit Catchment. The pH and conductivity could practically be used to assess the achievement of these guidelines on an ongoing operational basis. It is therefore proposed to release excess flood water from the pit to the Townshipspruit and Schoongezichtspruit if the water quality complies with the following guidelines:

pH	6 - 9
Conductivity	< 120 mS/m

Pumping plant of adequate capacity must be available to rapidly dewater the pit during flood conditions and to prevent the further deterioration of the pit water. Longer contact times between the flood waters and the pit floor and spoils material will result in gradual deterioration of the water quality. This may reduce the volume of flood water which can be discharged to the public stream.

6.2.9 GROUND-WATER

6.2.9.1 Minimising ground water impact

Mining operations will be conducted to allow the levelling topsoiling and vegetation of the spoils as rapidly as possible. The first row of spoils heaps behind the operating cut will remain unrehabilitated, until access can be gained for shaping and rehabilitation. The second row of spoils heaps can be shaped, topsoiled and vegetated as soon as is practically possible. Rehabilitation will be conducted in accordance with the rehabilitation and revegetation plan compiled for the Mini-Pit. It is proposed to replace subsoil where available, and to place a topsoil cover on the rehabilitated Mini-Pit of acceptable thickness.

It is essential to reconstruct a post-mining topoghraphy which will allow the pit surface to be free draining. The existing box cut will be filled and rehabilitated by the end of the first year of mining. Before the rehabilitation of the existing box cut, it will contribute surface water to the pit floor and mine workings.

6.2.9.2 River diversion seepage

The Townshipspruit will not be diverted.

6.2.10 Air quality

The objective is to minimise the amount of dust generated by the mining operations. The air quality will be monitored by the network established as described in the Landau Colliery EMPR. This network has been extended as described in section 2.11.

6.2.11 Noise

The objective is to minimise the amount of noise generated by mining operations and protect employees in high noise zones.
Air over-pressure levels measured from blast monitoring will be submitted monthly as is currently done for the No. 4 Seam mini-pit.

6.2.12 Sites of archaeological and cultural interest

No sites exist.

6.2.13 Sensitive landscapes

No sensitive landscapes have been identified.

6.2.14 Visual

The pit is visible from the public roads.

6.2.15 Regional socio-economy

There will be no change to the socio-economic structures of the Witbank area during the operational phase.

6.2.16 Interested and affected parties

Liaison will be maintained with Government Departments and the Schoongezicht Residents Council.

6.2.17 Submission of information

During the operational phase the mine will submit annual returns assisted by outside consultants. These reports will include results from routine monitoring with tables and graphical trends. Aspects that this report will cover are:

- Blast monitoring (air and ground vibrations).
- Dust monitoring.
- Surface water monitoring.
- Ground water monitoring.
- Management of rehabilitated opencast areas.
- Management of discard dumps.

In addition to the above, more frequent reports on selected aspects will continue to be submitted to the authorities as required by legislation or on request.

Detailed comments on the methods and timing of the planned monitoring programmes will be supplied on request.

6.2.18 MAINTENANCE

6.2.18.1 Rehabilitated land

During the operational phase the mine undertakes to maintain rehabilitated opencast land, for a period of at least three years after initial seeding. This will entail fertilising, reseeding areas where the grass has not established, repairs to surfaces that have been eroded, etc. Thereafter, rehabilitated land will be maintained in a stable and productive state by appropriate fertilization and utilization strategies based on regular monitoring of the land involved.

6.2.18.2 Water pollution control structures

All presently constructed and future water pollution control structures will be maintained in good order through to the decommissioning phase. Routine inspections will be carried out and repair work carried out where necessary.

6.2.18.3 Rehabilitated residue deposits

Residue dumps to be utilised are covered in the Landau and Kleinkopje Collieries EMPR's.

6.3 DECOMMISSIONING PHASE AND CLOSURE

6.3.1 Closure objectives

No permanent structures will be erected. All temporary structures will be removed and the land they occupy tilled, fertilized and seeded.

The mini-pit area will have final voids filled, sloped, the area rehabilitated and returned for township development. The Schoongezicht Residents Council have requested that areas be levelled so as to facilitate sports fields for the residents. This request has been agreed to by the mine, where possible. The pollution control measures implemented during mining will be operated and maintained by Landau Colliery after closure of the mini-pit.

6.3.2 Infrastructure and surface rehabilitation

The rehabilitation measures described in this section will conform with the requirements of Section 60 of the Minerals Act.

All temporary buildings and structures will be removed by the contractor as well as their foundations.

6.3.3 Mine residue deposits

At present there are 3 discard dumps and 2 roofcoal stockpiles in the area. It is planned to selectively mine Schoongezicht No 1 dump and transport the washable portion of the coal to Klipfontein plant for beneficiation. The non-washable portions will be incorporated into Schoongezicht No 2 dump, (which is a purely discard dump), and for the No 2 dump to be rehabilitated, Schoongezicht No 3 dump will also be rehabilitated. The burnt portions of Schoongezicht No 1 dump will be transported to Blaauwkrans discard disposal unit.

During the mining of the mini-pit the roof coal arising from the operation will be washed on a trial basis and marketed, at which stage a decision can be made as to whether the roof coal is to be washed or stockpiled.

6.3.3.1 Disposal facilities

Not applicable.

6.3.3.2 Control of seepage and rain water

We are proposing that the stormwater runoff from the undisturbed area upslope of the pit be diverted around the rehabilitated pit. From a surface recharge point of view, it is not advisable to allow clean runoff which could increase the infiltration into the pit water system to cross the rehabilitated pit, even in the post-mining scenario. We would therefore recommend that the upslope stormwater diversion constructed in the last year of the mining operation be of a permanent nature and be constructed in accordance with Regulation 287 of the Water Act.

The post-mining topography must allow the free draining of the rehabilitated pit. Post-mining care and maintenance will have to be conducted to infill any formation of local depressions or collapses, which could result in local high recharge to the pit. The proposed post-mining topography caters for a drainage line running in an east-west direction along the northern part of the rehabilitated pit. This drainage line should be constructed to a maximum slope of 1 in 200, depending on the rehabilitation cover soil characteristics. The slope should not fall below 1 in 500 to allow adequate drainage. The pit surface will therefore drain towards the Schoongezichtspruit. Adequate erosion control structures will be installed at the drainage points into the surface water drainage line as well as at the discharge point back to the natural surface topography.

The rehabilitated pit will fill with time and the estimate to reach the sub-surface decant zone is 12 to 18 years, depending on the future rainfall pattern. It is not advisable to allow the development of an uncontrolled seepage zone. Consideration can be given to passive treatment of this seepage water if such technology is proven by the time the Mini-Pit approaches closure. This will involve the construction of a barrier trench filled with organic material through which the seepage water will flow before surfacing. There are a number of such installations in the world, and this is currently being researched as part of a Water Research Commission project. The small scale of the Mini-Pit operation would make it a candidate for such passive treatment technology.

The alternative approach would be to intercept the excess mine water before it seeps from the pit. This can be done by constructing a hydraulic connection below the level of the decant zone to either the existing Schoongezicht underground workings or to the Schoongezicht surface pollution control dams. The water flowing from the Mini-Pit will then be integrated into the overall Landau Colliery water system. This will allow re-use and/or treatment at a central facility. The post-mining management of the excess Mini-Pit water will therefore form an integral part of the overall Landau Colliery water management.

6.3.3.3 Long-term stability

The area mined by opencast and subsequently rehabilitated will be stable, but will require localised maintenance for minor settling of the spoils. No buildings can be constructed on these areas.

6.3.3.4 Final rehabilitation in respect of erosion and dust control

Post-mining slopes and vegetation cover described in this report will eliminate dust being generated from rehabilitated mine areas.

Erosion control over rehabilitated ground will require ongoing management, as practised in agriculture.

6.3.4 Sealing of workings and dangerous excavations

All final voids will be sloped to gradients acceptable for the proposed township plan. No vertical high-walls will be left.

6.3.5 Final opencast rehabilitation

All ramps and final voids will be infilled and sloped to gradients acceptable for township development. Top soiling and vegetating will be carried out in accordance with the post-mining land capability which will be defined in the July 1997 report.

6.3.6 Submission of information

Post de-commissioning and through to closure Landau Colliery will continue to submit the following information as part of its annual returns on the mini-pit.

- Dust monitoring.
- Erosion of rehabilitated land and water courses.
- Vegetation cover.
- Water quality and quantities leaving the mine's property.

6.3.7 Maintenance

Maintenance of the de-commissioned site will continue for a period of three years under the responsibility of Landau Colliery.

6.4 PROPOSED TIMETABLE, DURATION AND SEQUENCE

6.4.1 Prospecting project

Not applicable.

6.4.2 Mining project

Mining commenced in April 1997.

6.4.2.1 Submission of EMPR and application for mining authorization

Temporary Mining Authorization has been granted in terms of letter reference OT 6/2/2/141 dated 12th May 1997, received from the Department of Mineral and Energy Affairs - Witbank.

The preliminary EMPR for the mini-pit was submitted at the request of the DMEA and DWAF and was tabled on 13 February 1997.

6.4.2.2 Construction period

A short construction period of 1 month took place during April 1997.

6.4.2.3 Duration of mining activities

Mining activities are planned to span 1997, 1998, 1999 and 2000 at a rate of some 750 000 sales tons per annum.

6.4.2.4 Rehabilitation programme

After cessation of mining in 2000 all rehabilitation will be completed within one year.

Maintenance of the rehabilitated area will span three years.

6.4.2.5 Dates for closure

Based on the above programme closure will be applied for in the year 2003.

6.4.2.6 De-commissioning and after-care programme

The after-care programme for spoils water management will rest with Landau Colliery and form part of its closure plan.

6.4.2.7 Date for closure application

The anticipated date for closure application will be 2003.

6.5 FINANCIAL PROVISION

A Pollution Control Fund has been established by Amcoal to provide the necessary funds to complete closure requirements of its mines. The mini-pit will contribute to these funds to provide for the de-commissioning and closure phases described in this EMPR.

The complete "Pollution Control Fund" for South African Coal Estates (incorporating Landau Colliery) has been lodged with the Regional Director - Eastern Transvaal and formed part of the application for Mining Authorization.

PART 7: CONCLUSION

Amcoal Management is committed to integrated environmental management. Responsibility is delegated to mine management to evaluate environmental impacts and implement management programmes. Adequate funds are provided to ameliorate negative impacts, both during operation and after mine closure.

The principal aspects of Amcoal's management approach include:

- Effective communication with government agencies and affected parties.
- Professionally designed environmental control measures.
- The use of specialist consultants when in-house skills are unavailable.
- Compliance with legal requirements based on BATNEEC.
- Monitoring of the implementation of the environmental programme.
- Compliance audits conducted on a regular basis.

The Amcoal Pollution Control Fund was established in August 1977 for each of its operating mines. This fund ensures that adequate pecuniary measures are provided for in terms of Section 9(5)e of the Minerals Act for mine closure. The contributions made to this fund are reviewed annually to ensure that funding levels are sufficient to meet the standards agreed to in the EMPR and any amendment that may from time to time occur.

PART 8: STATUTORY REQUIREMENTS

Table 8.1.1 lists the permits and permissions obtained from Government Departments which are directly related to environmental issues.

TABLE 8.1.1 Permits and permissions

PERMIT DESCRIPTION	AUTHORITY	PLACE OF ISSUE	DATE OF PERMISSION	PERMIT/ REGISTRATION NO	STATUTE
Use of water for industrial purposes	DWAF	Pretoria	12.6.92	1407 N	Water Act Section 12 (1)

This supersedes the following permits:

			30.03.67 11.11.77 03.05.88	175 N 484 N 1171 N	

Application for Mining Authorization in terms of Section 39(4)	DWAF	Pretoria	22.4.97	16/2/7/B100/C12	Minerals Act Section 39(4)

Table 8.1.2 lists the permits and permissions obtained from Government Departments which are interested and effected by the mining operations.

TABLE 8.1.2

PERMIT DESCRIPTION	AUTHORITY	PLACE OF ISSUE	DATE OF PERMISSION	PERMIT/ REGISTRATION NO	STATUTE
Blasting within 500m of 132 Kv Eskom line	Eskom	Pretoria	21.4.97	SO/74/97	Minerals Act Regulation 9.33.5
Mining within 100m, including blasting of 21Kv Old Douglas line	Eskom	Pretoria	21.4.97	SO/74/97	Minerals Act Regulation 5.3.1
Mining within 100m and blasting within 500m of Provincial Road P154-2	Mpumalanga Government Public Works, Roads and Transport Roads Branch	Lydenburg	24.4.97	F15/PV02	Minerals Act Regulation 5.3.1 Regulation 9.33.5 Advertising on Roads and Ribbon Development Act, 1940 and Roads Ordinance (22 of 1957)
Mining within 100m and blasting within 500m of Spoornet Property	Spoornet	Pretoria	25.4.97	S.PTA/W 1076/4/1	Minerals Act Regulation 5.3.1 Regulation 9.33.5
Mining within 100m and blasting within 500m of a National Route	Department of Transport	Pretoria	5.5.97	11/5/3-4/3-28	Article 13(1) to 13(9) of National Roads Act 1971 Minerals Act Regulation 5.3.1 Regulation 9.33.5

PART 9: AMENDMENTS

This report constitutes an addendum to the Landau Colliery EMPR.

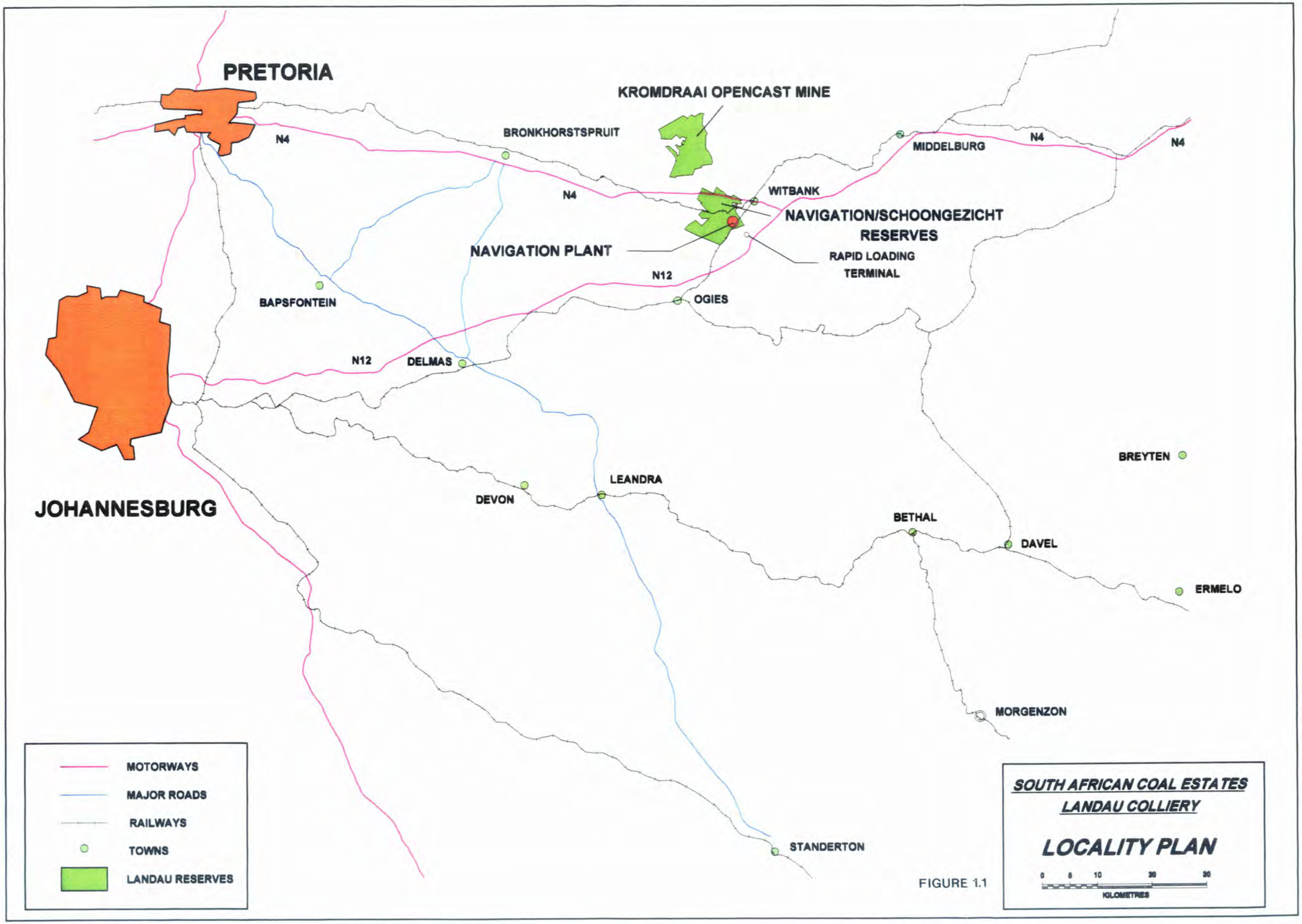

PRETORIA
JOHANNESBURG
KROMDRAAI OPENCAST MINE
BRONKHORSTSPRUIT
N4
N4
MIDDELBURG
N4
N4
WITBANK
NAVIGATION/SCHOONGEZICHT RESERVES
NAVIGATION PLANT
RAPID LOADING TERMINAL
N12
OGIES
BAPSFONTEIN
N12
DELMAS
LEANDRA
DEVON
BREYTEN
BETHAL
DAVEL
ERMELO
MORGENZON
STANDERTON
MOTORWAYS
MAJOR ROADS
RAILWAYS
TOWNS
LANDAU RESERVES
SOUTH AFRICAN COAL ESTATES
LANDAU COLLIERY
LOCALITY PLAN
0 5 10 20 30
KILOMETRES

FIGURE 1.1

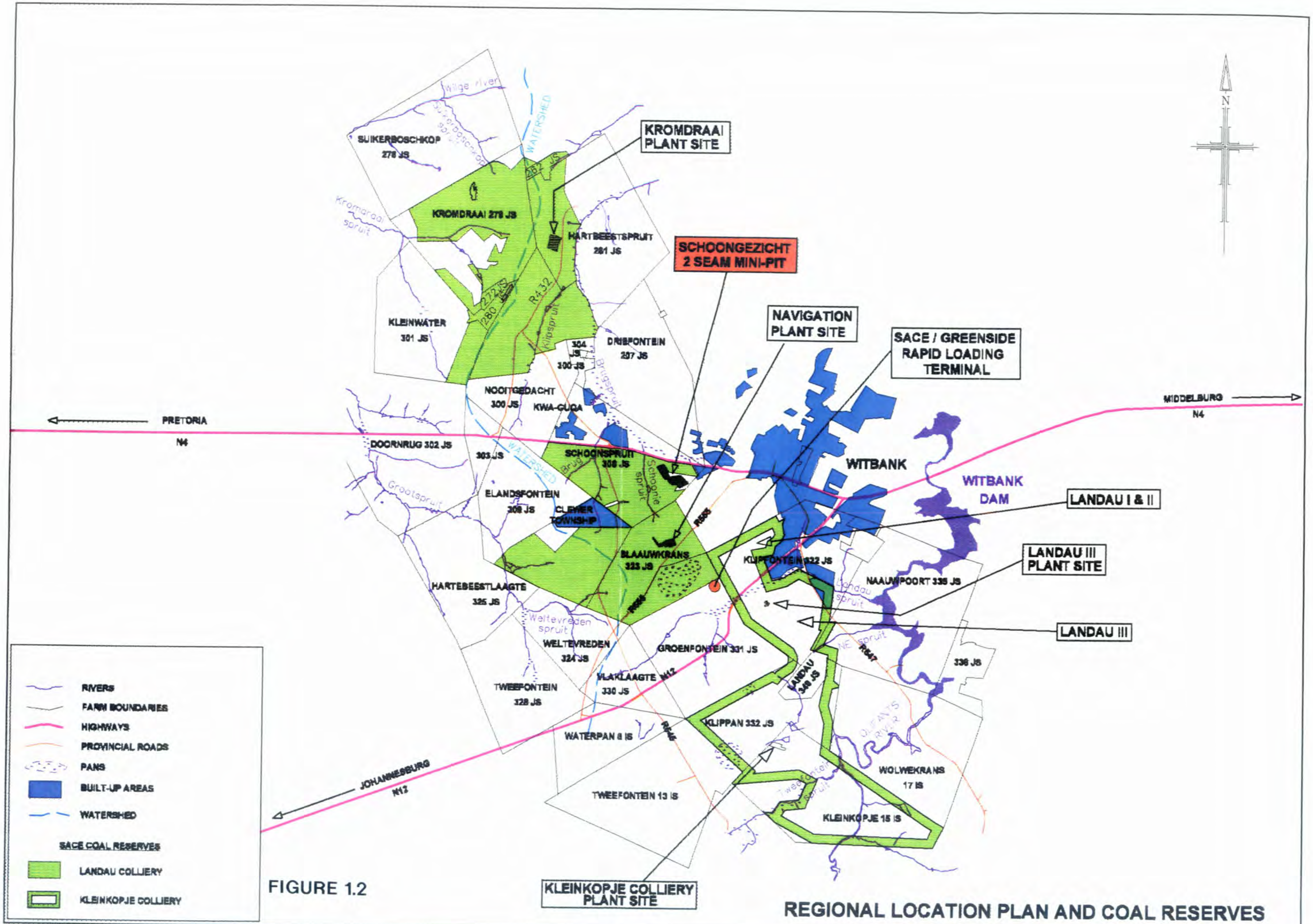


FIGURE 1.2

REGIONAL LOCATION PLAN AND COAL RESERVES

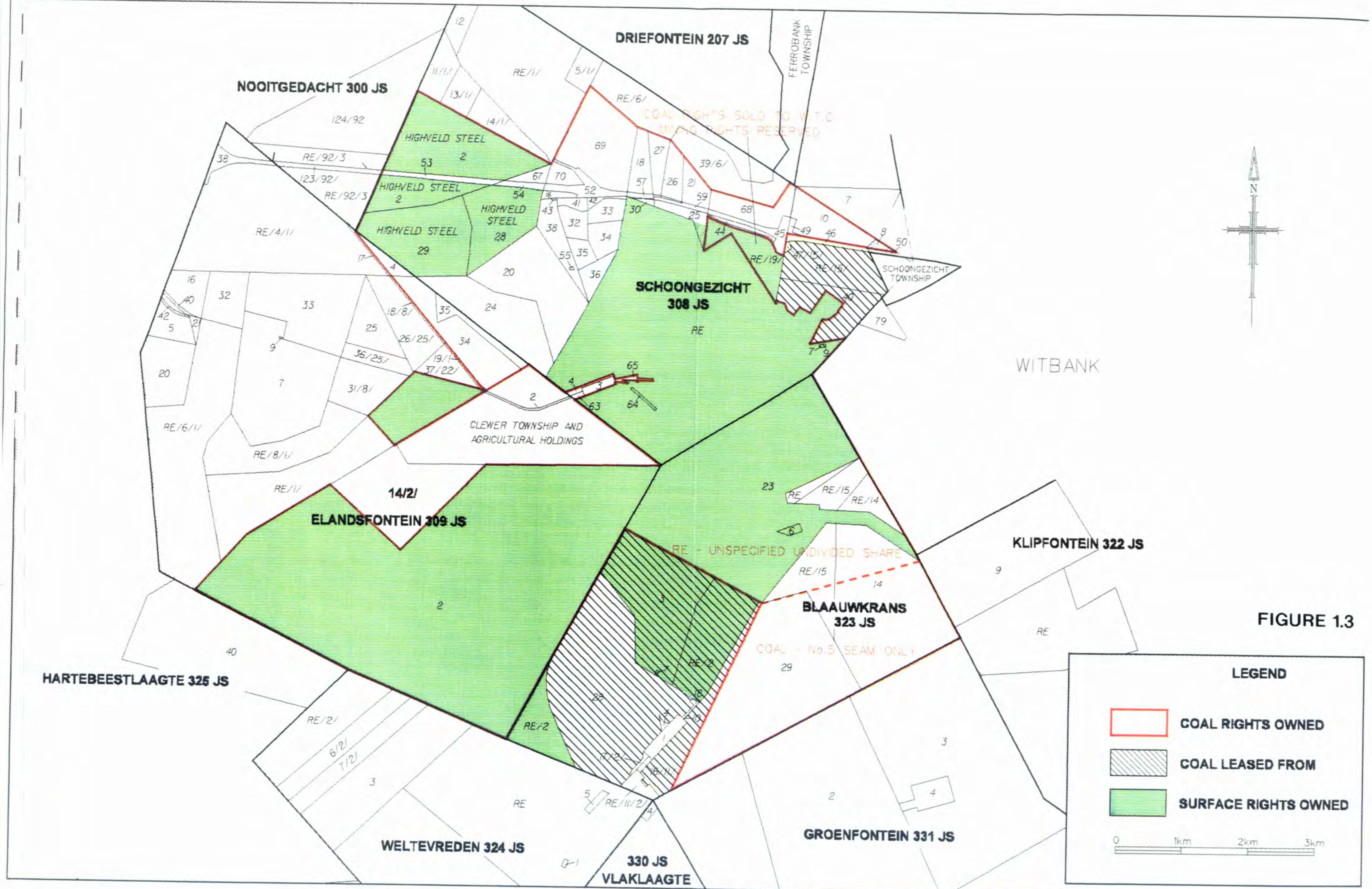


FIGURE 1.3

COAL AND SURFACE RIGHTS - SCHOONGEZICHT / NAVIGATION

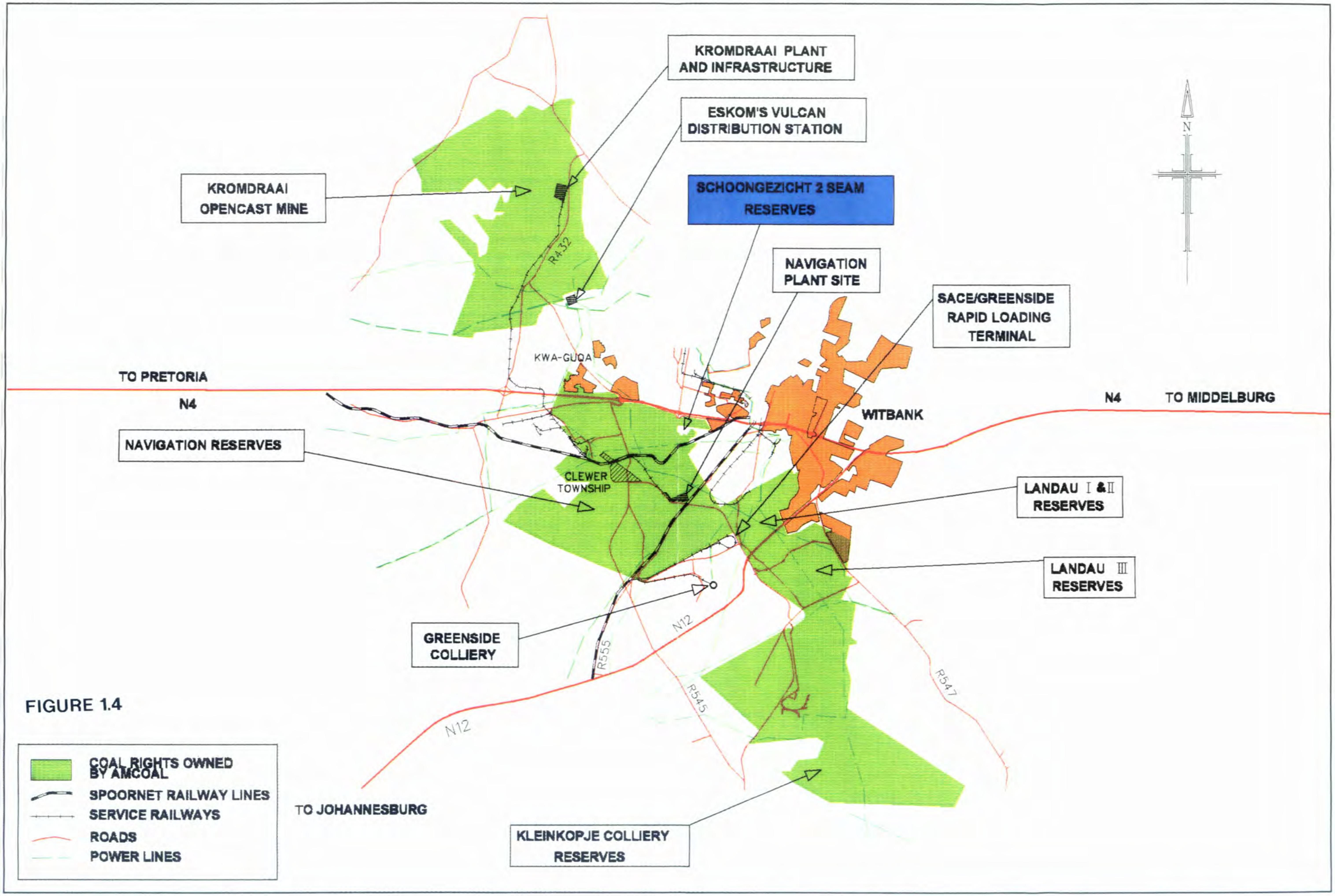
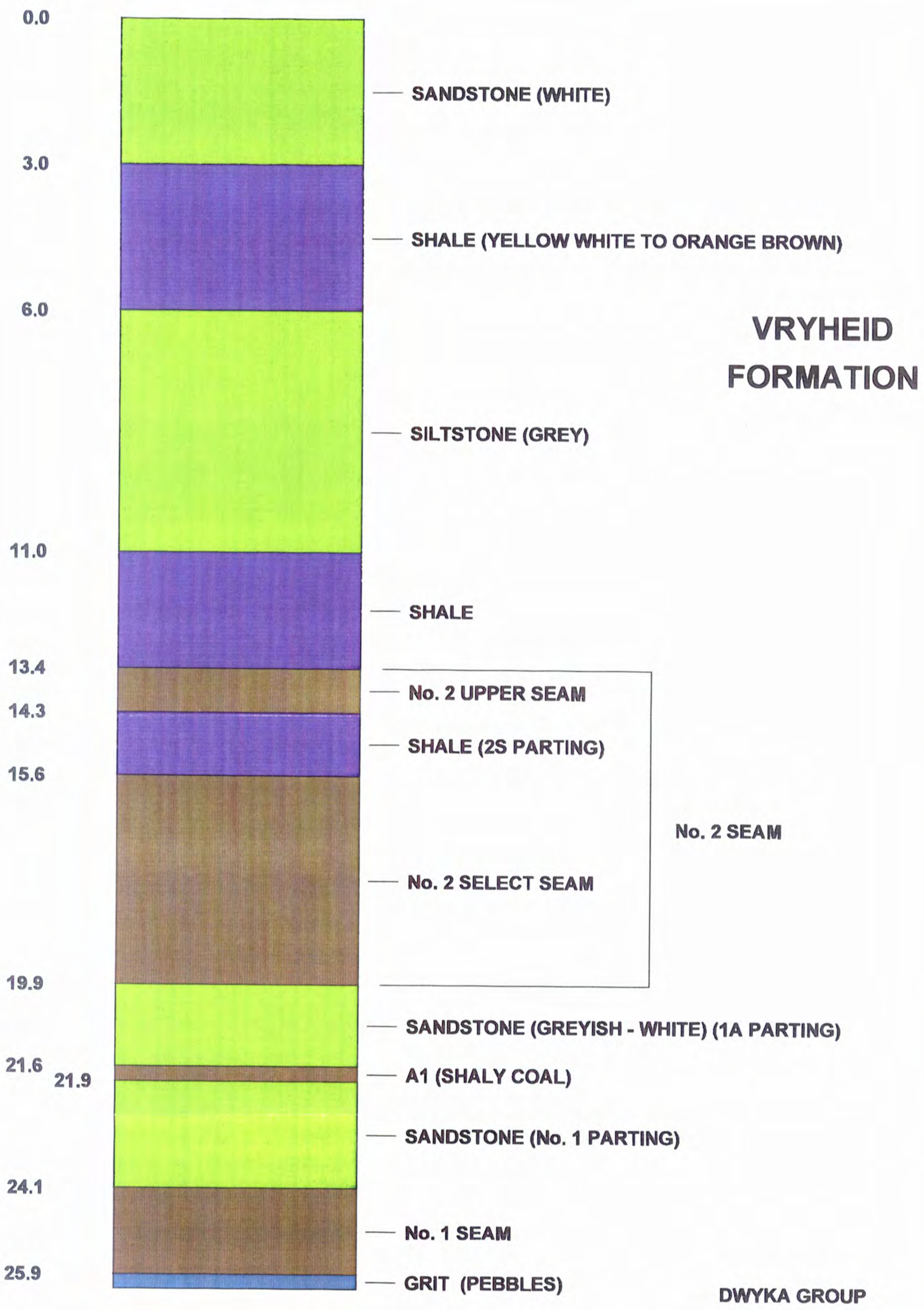


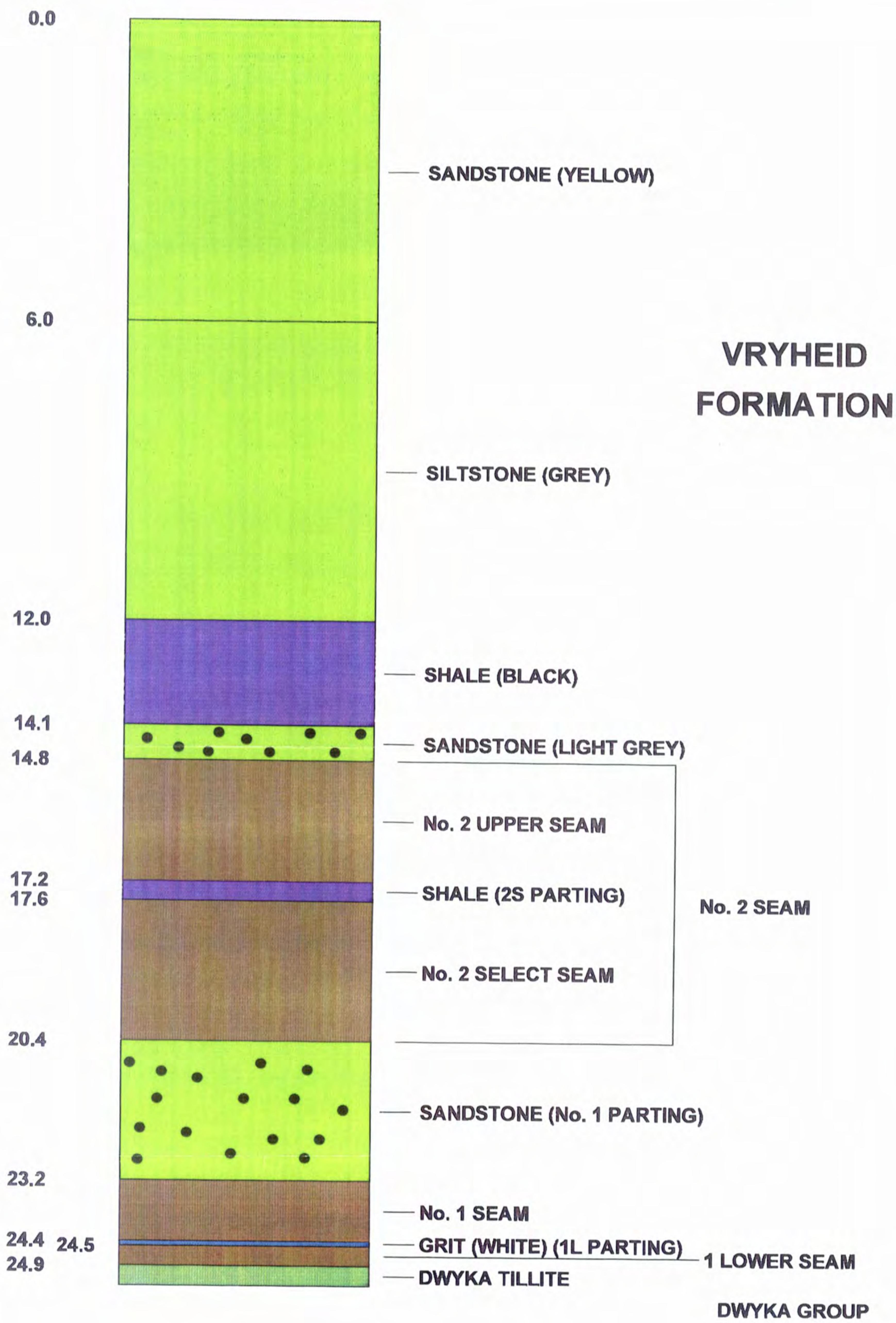
FIGURE 1.4

MAJOR INFRASTRUCTURE NETWORK



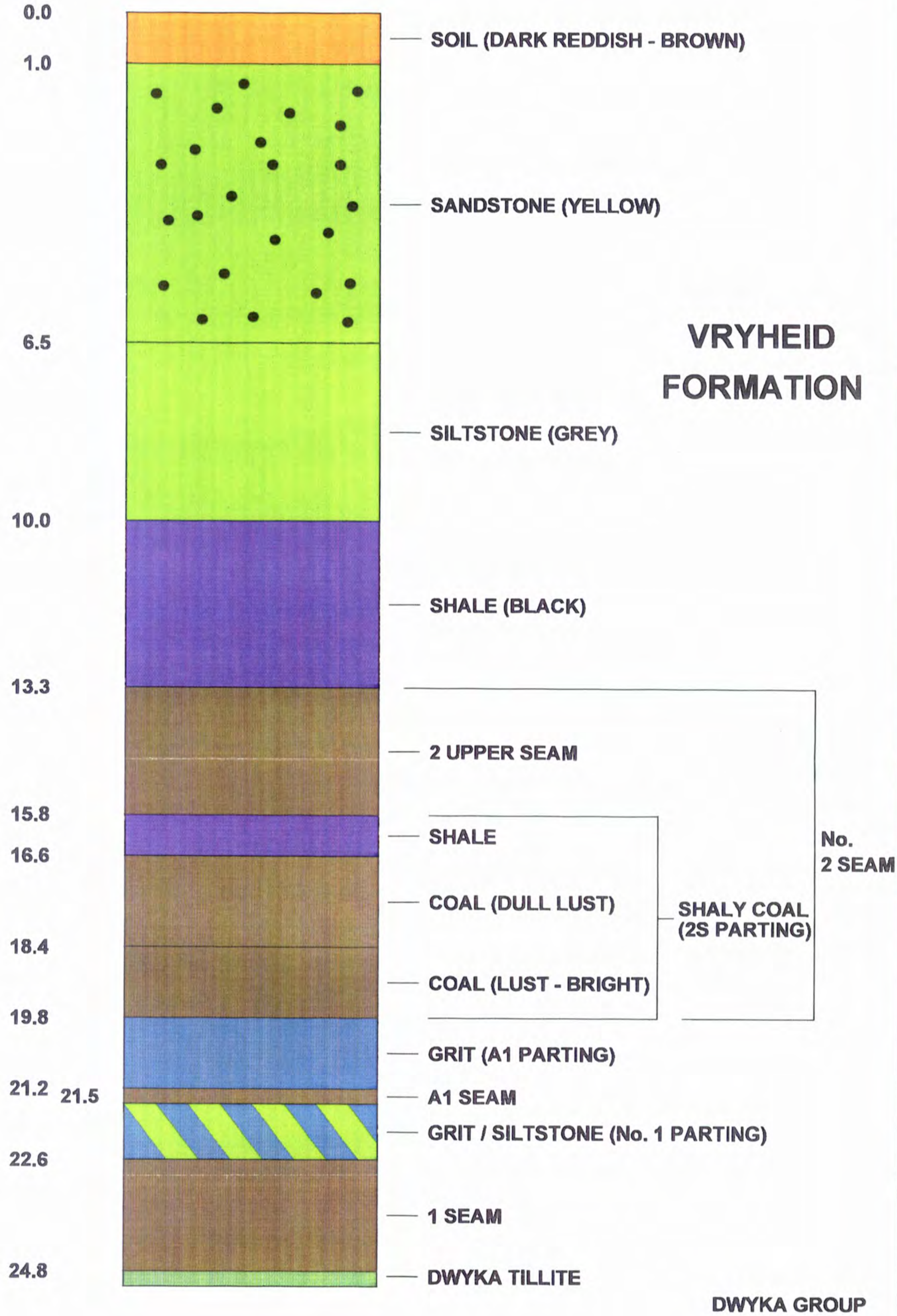
LOG OF BOREHOLE 2634

FIGURE 2.1(a)



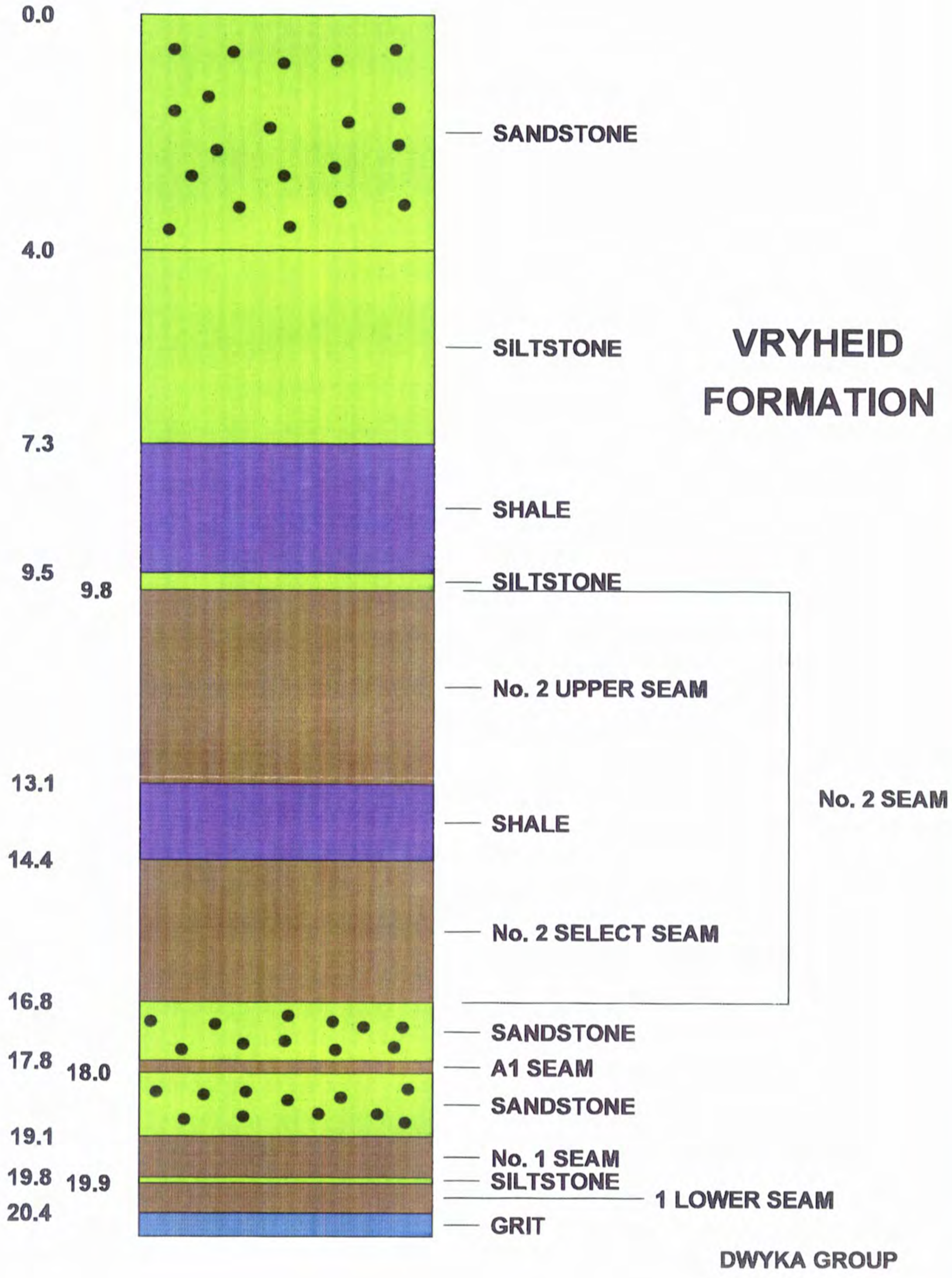
LOG OF BOREHOLE 2657

FIGURE 2.1(b)



LOG OF BOREHOLE 2680

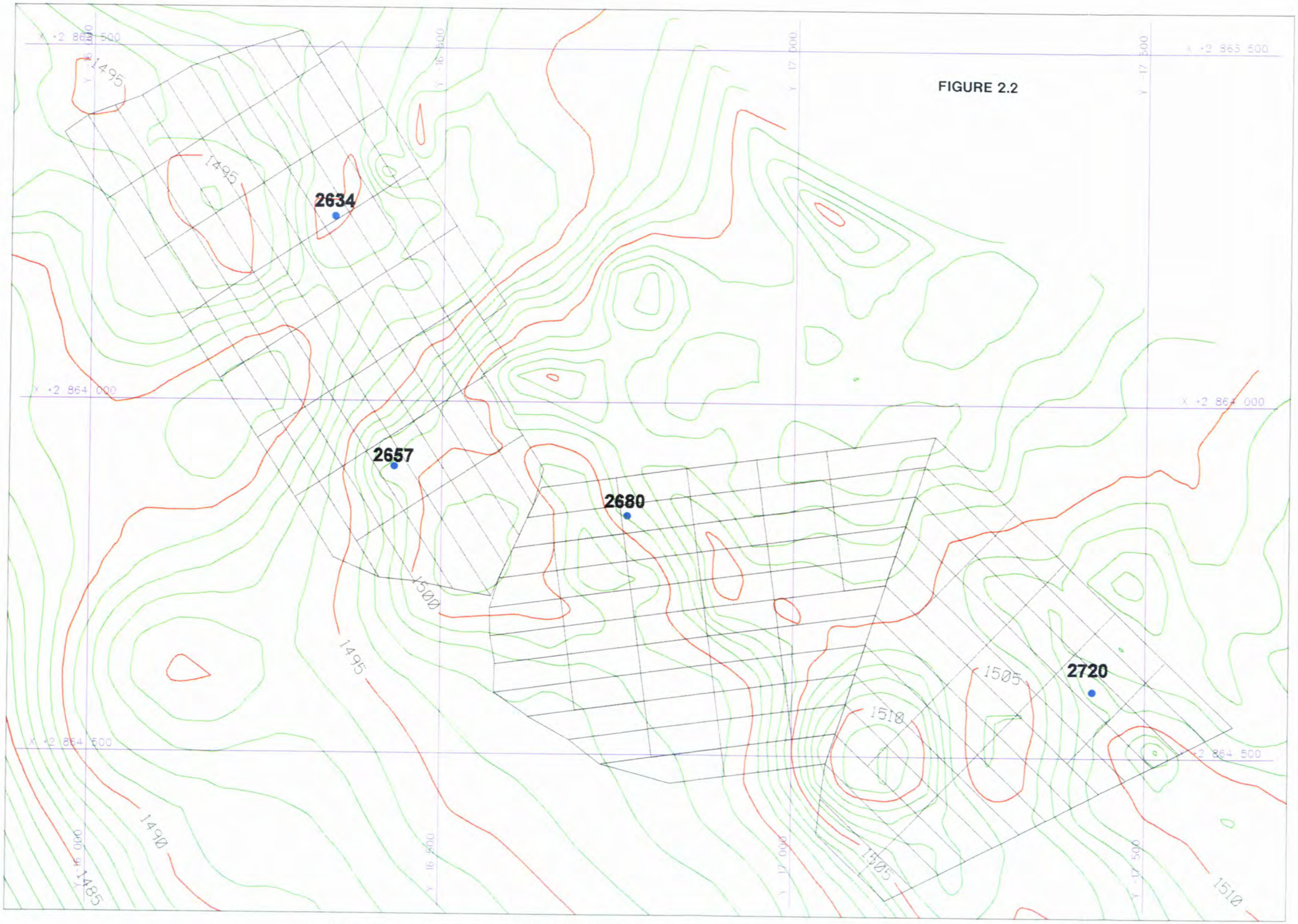
FIGURE 2.1(c)



LOG OF BOREHOLE 2720

FIGURE 2.1(d)

FIGURE 2.2



MINI-PIT LAYOUT, LOCATION OF BOREHOLES AND No. 1 SEAM FLOOR CONTOURS (AMSL)

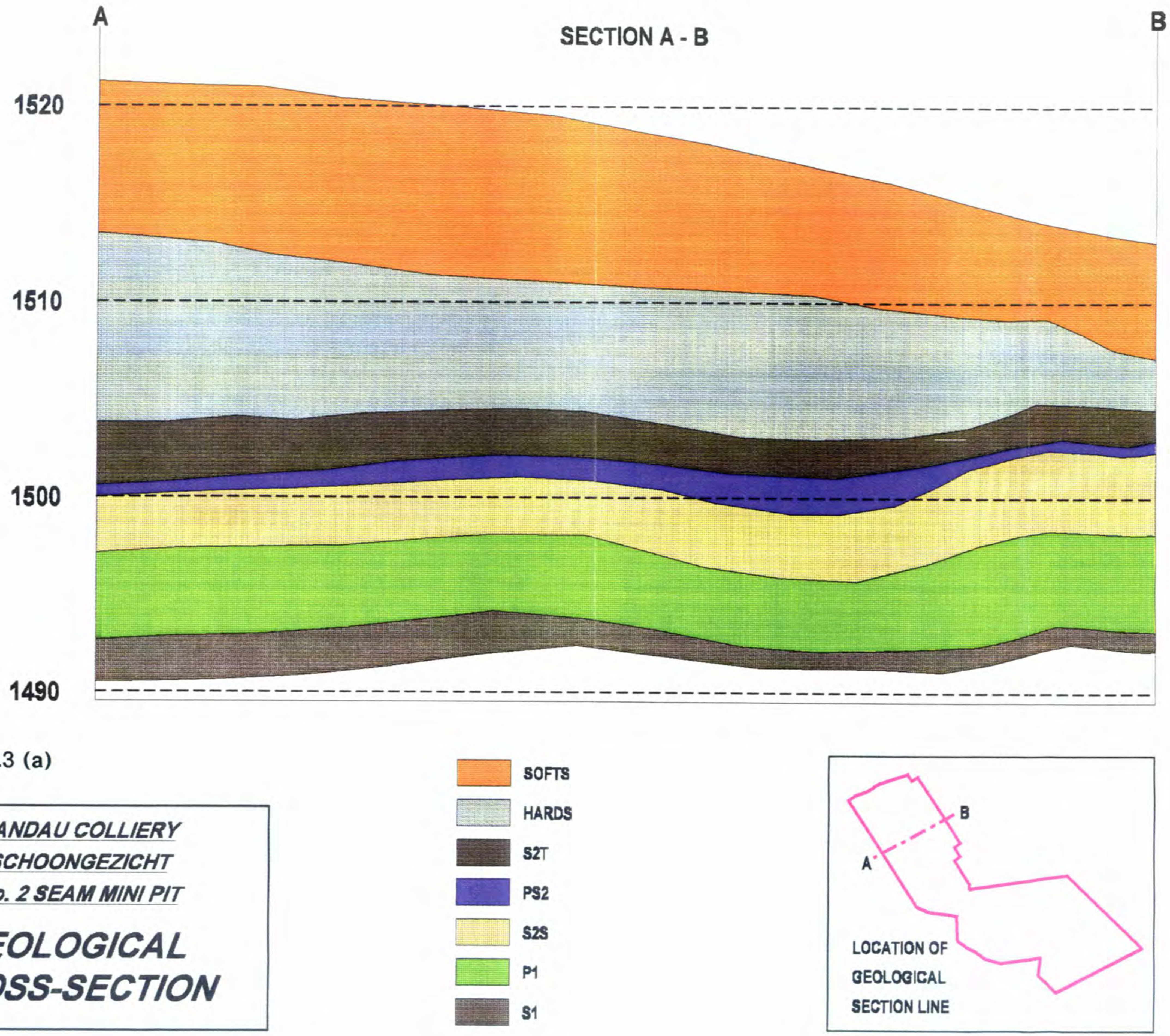


FIGURE 2.3 (a)

LANDAU COLLIERY
SCHOONGEZICHT
No. 2 SEAM MINI PIT

GEOLOGICAL CROSS-SECTION

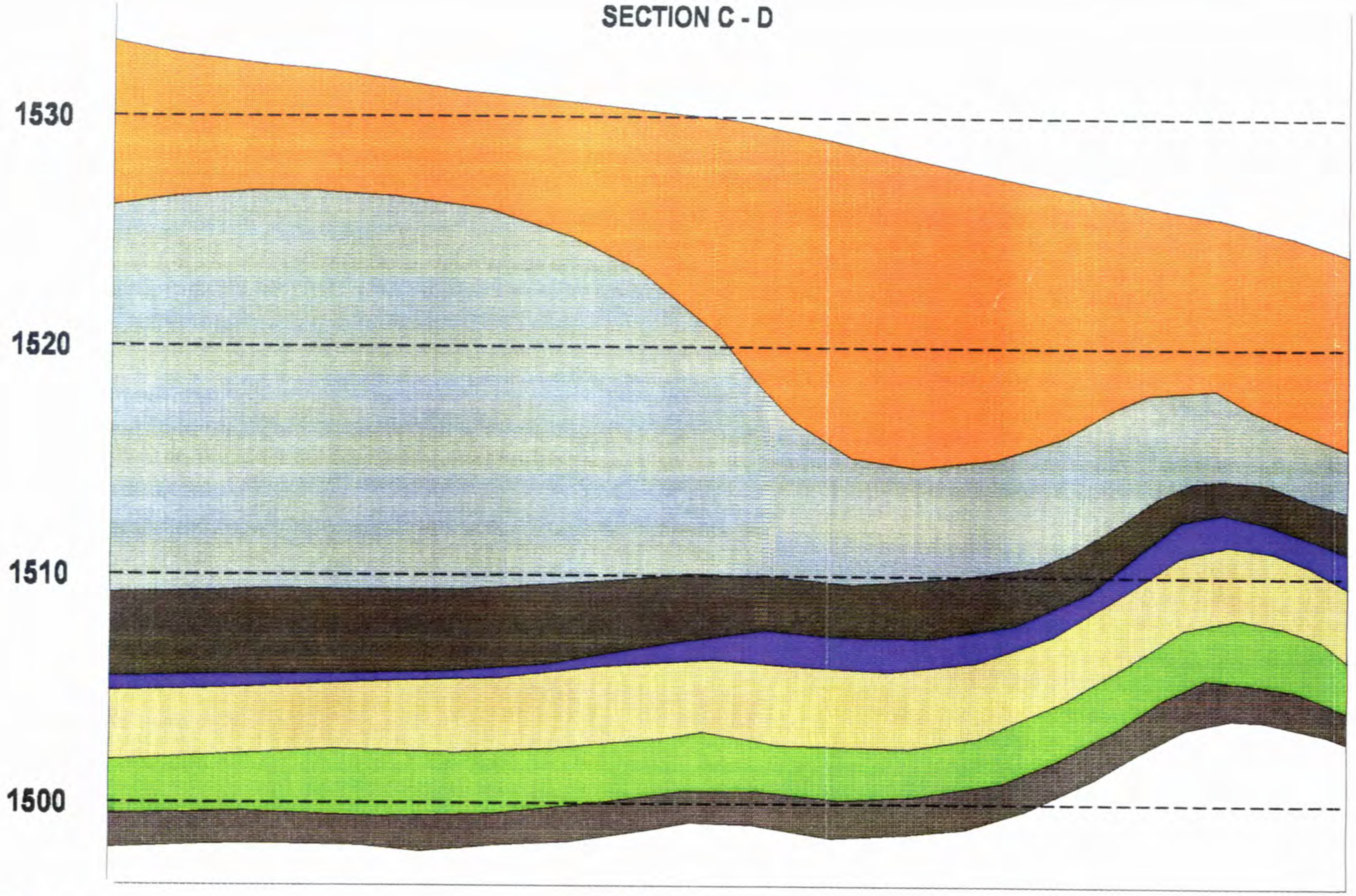
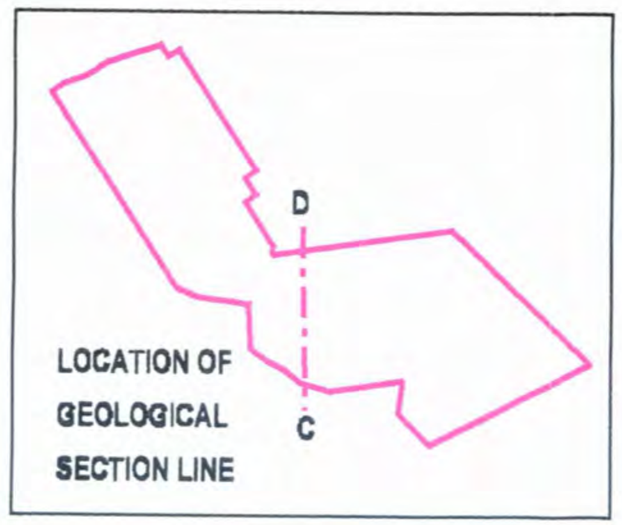


FIGURE 2.3 (b)



LANDAU COLLIERY

SCHOONGEZICHT

No. 2 SEAM MINI PIT

GEOLOGICAL CROSS-SECTION

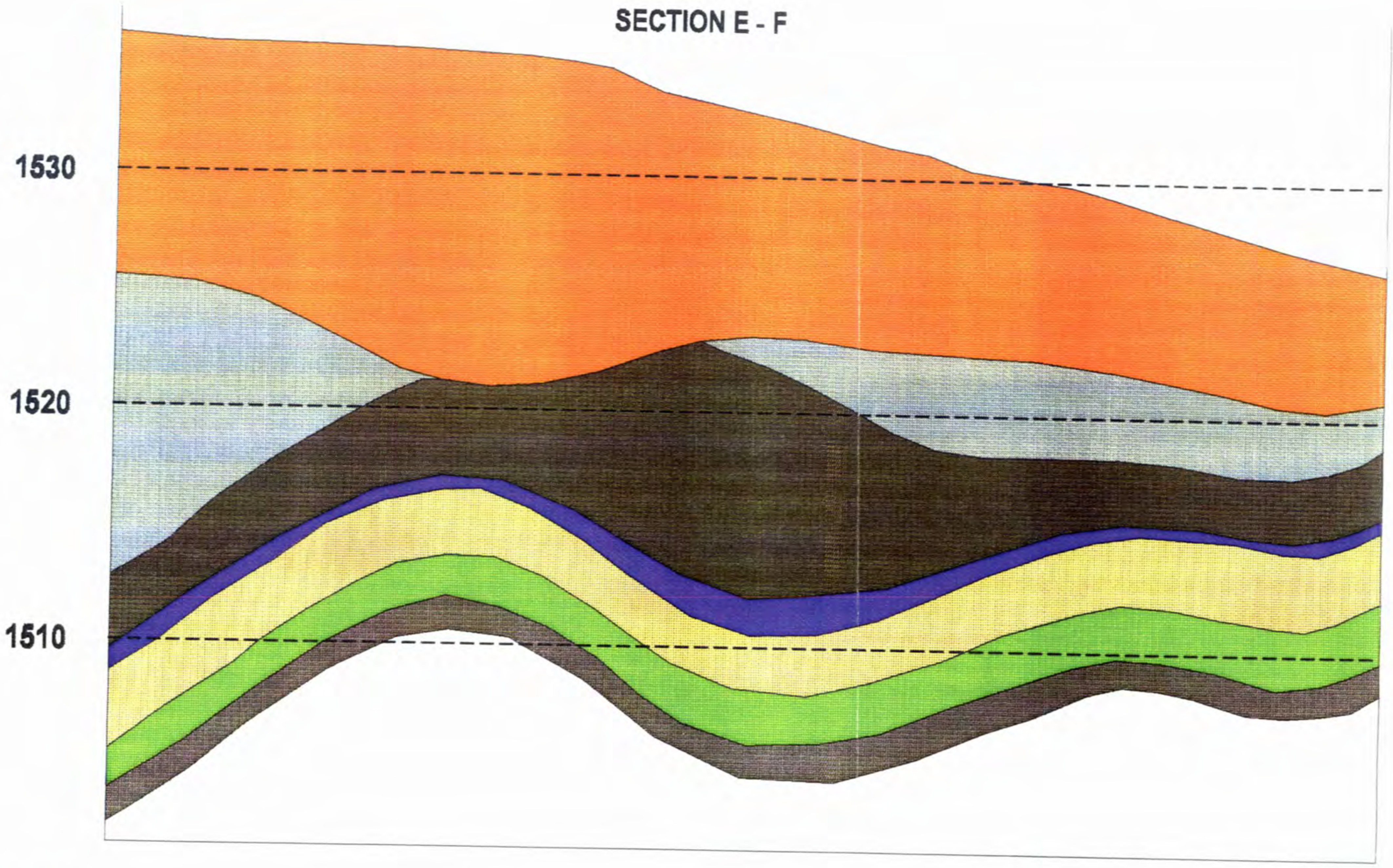


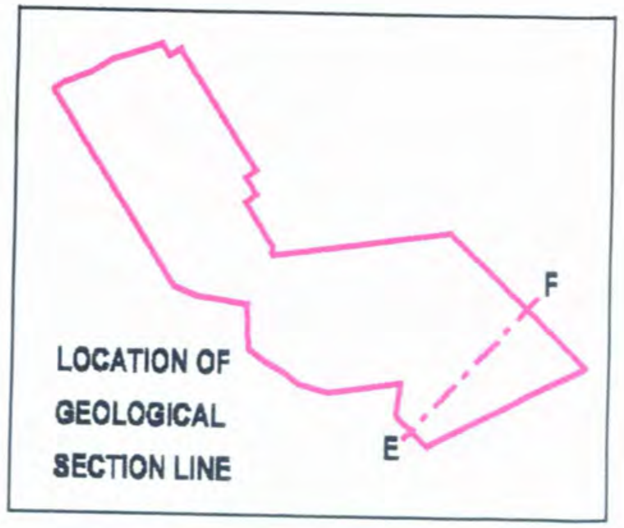
FIGURE 2.3 (c)

LANDAU COLLIERY

SCHOONGEZICHT

No. 2 SEAM MINI PIT

GEOLOGICAL CROSS-SECTION



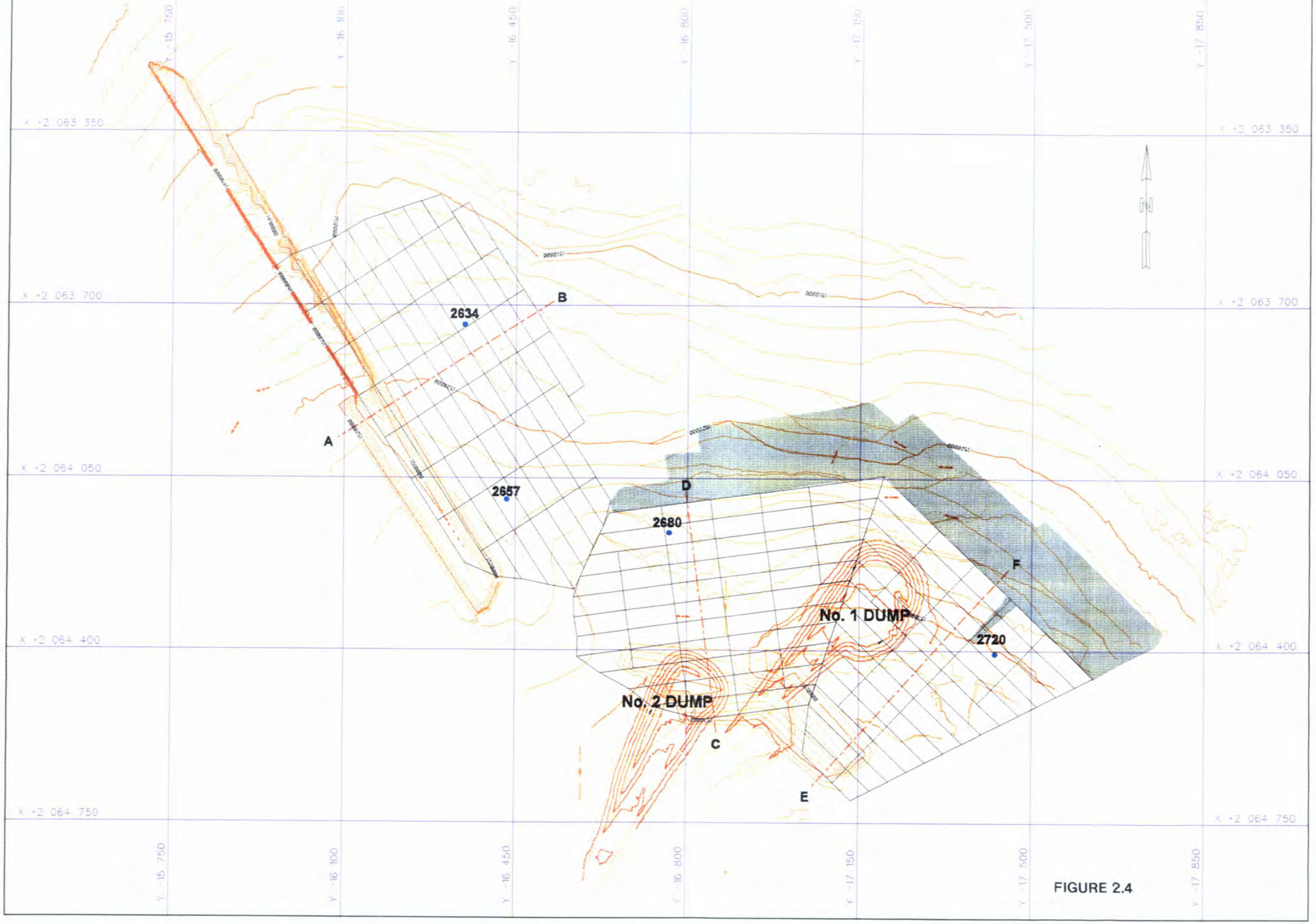
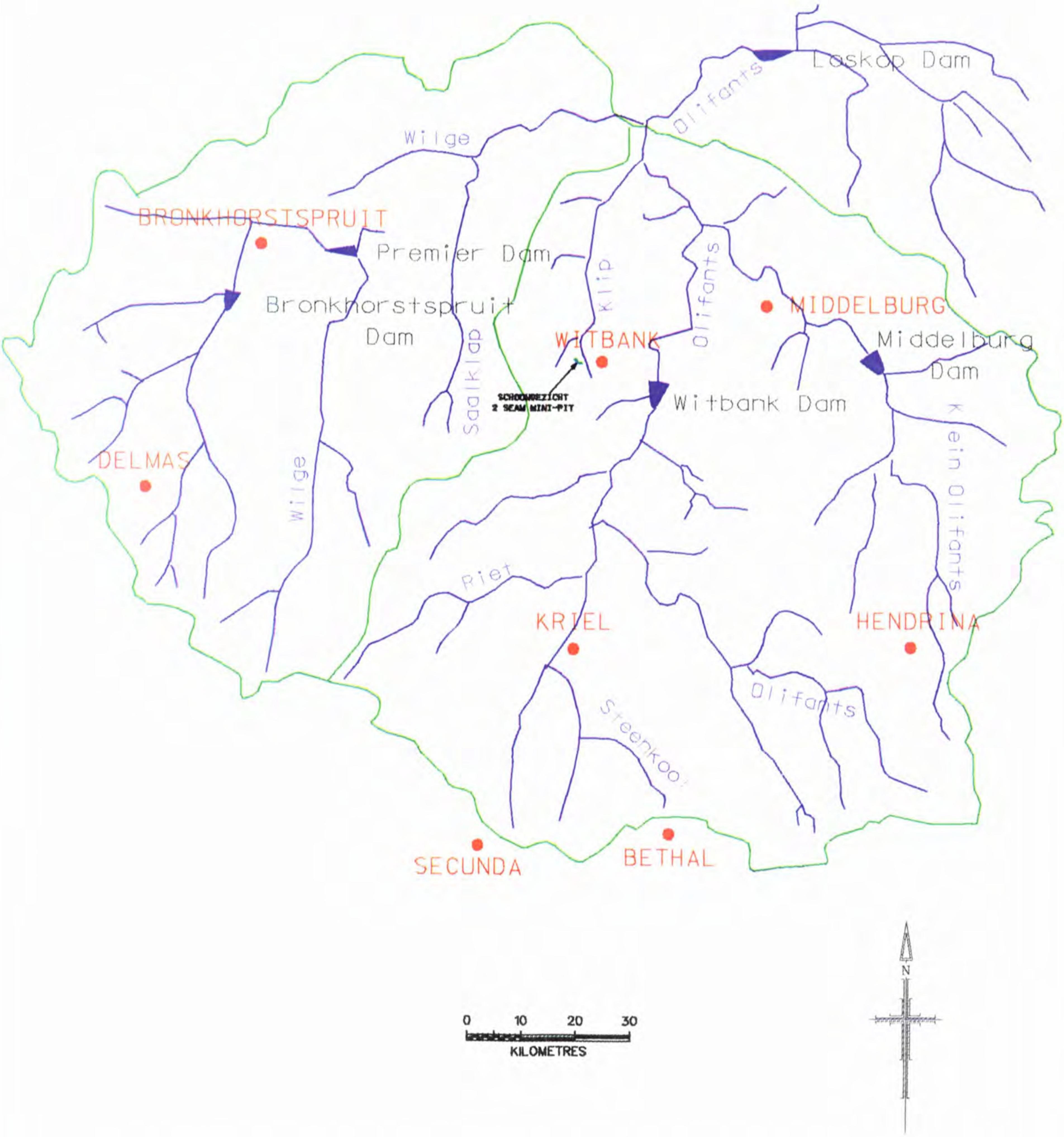


FIGURE 2.4

PRE-MINING SURFACE TOPOGRAPHY AND SECTION LINES



STREAMS & CATCHMENTS OF THE UPPER OLIFANTS RIVER

FIGURE 2.10

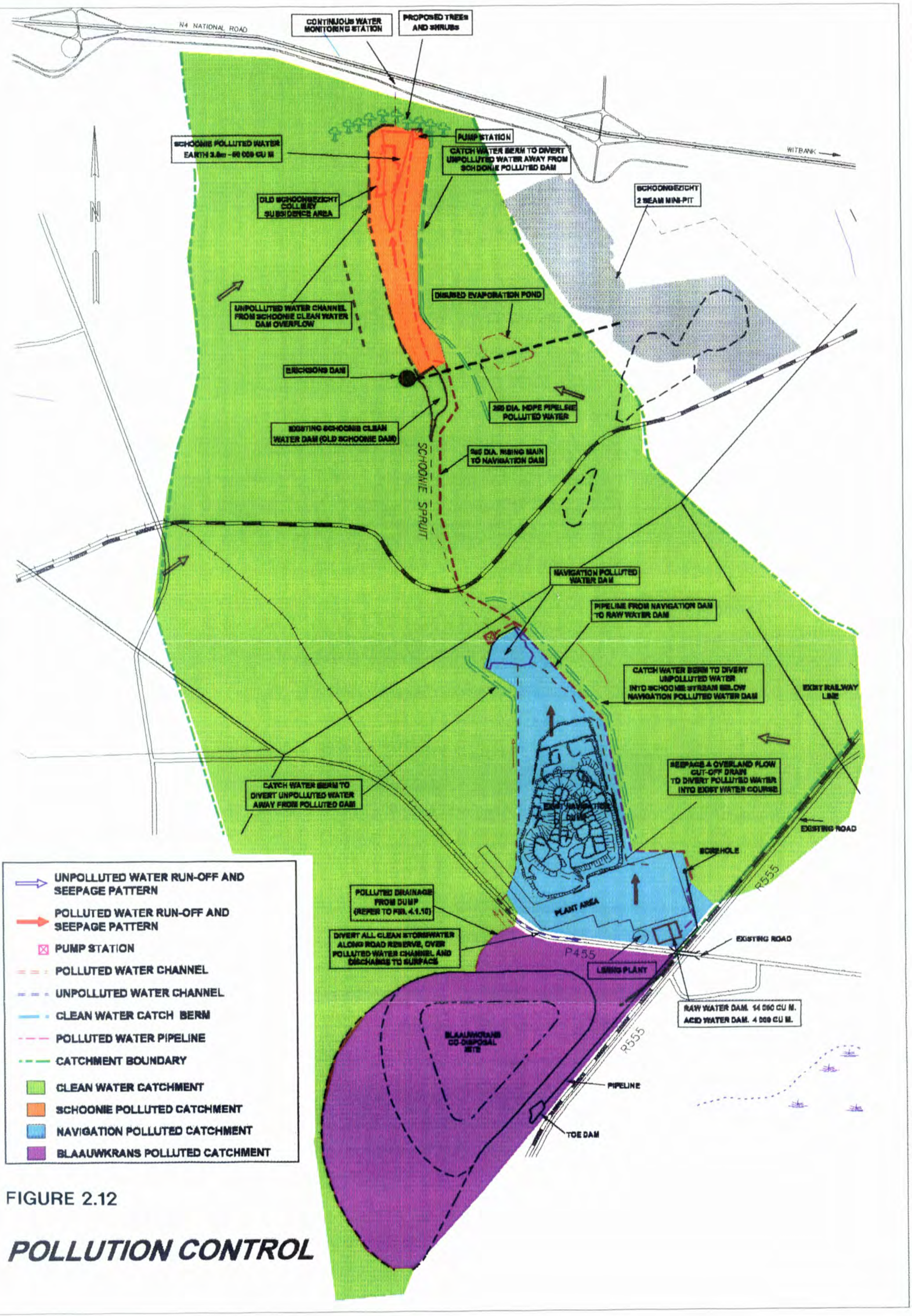
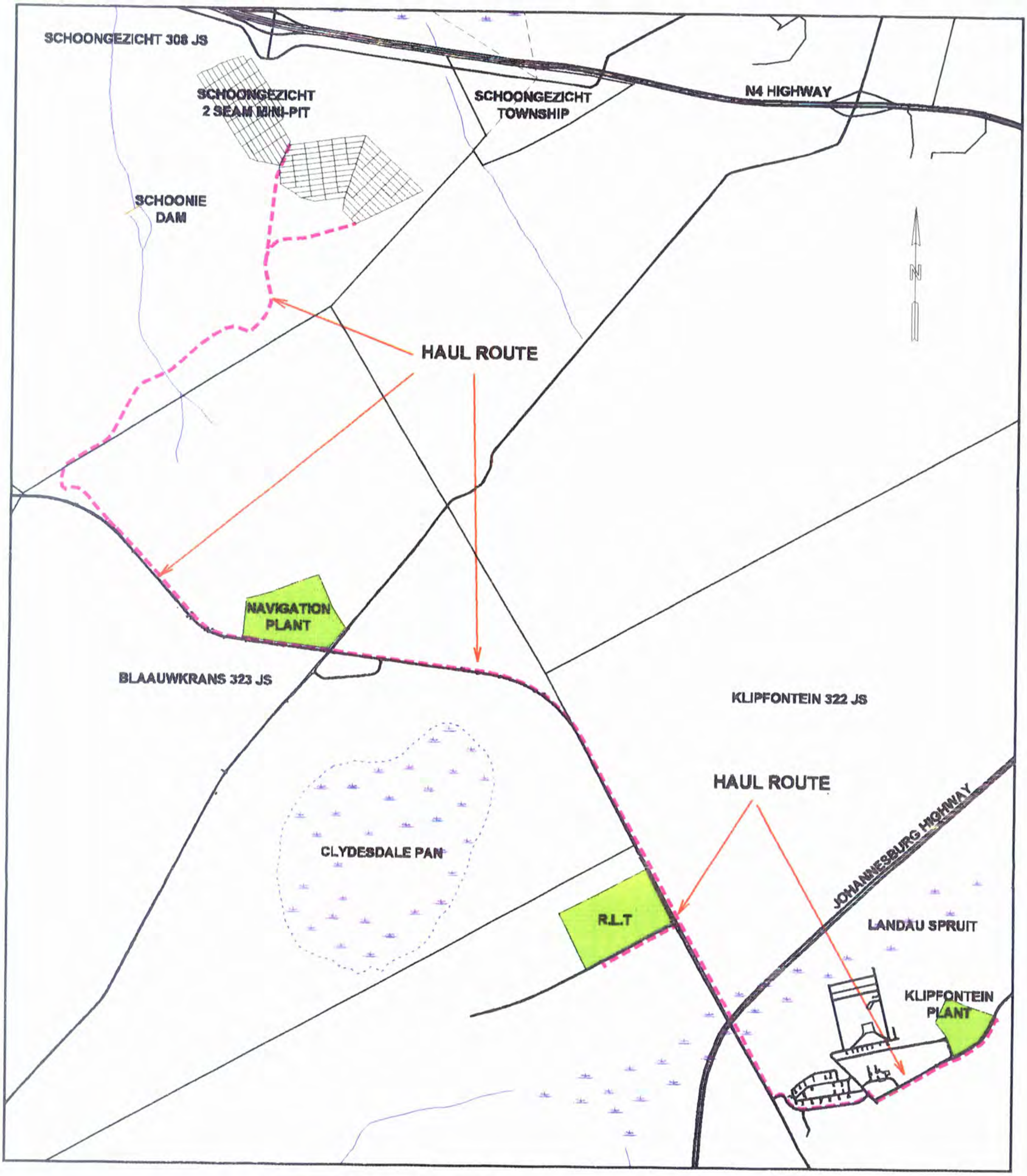


FIGURE 2.12

POLLUTION CONTROL



HAUL ROUTES TO NAVIGATION, R.L.T. AND KLIPFONTEIN

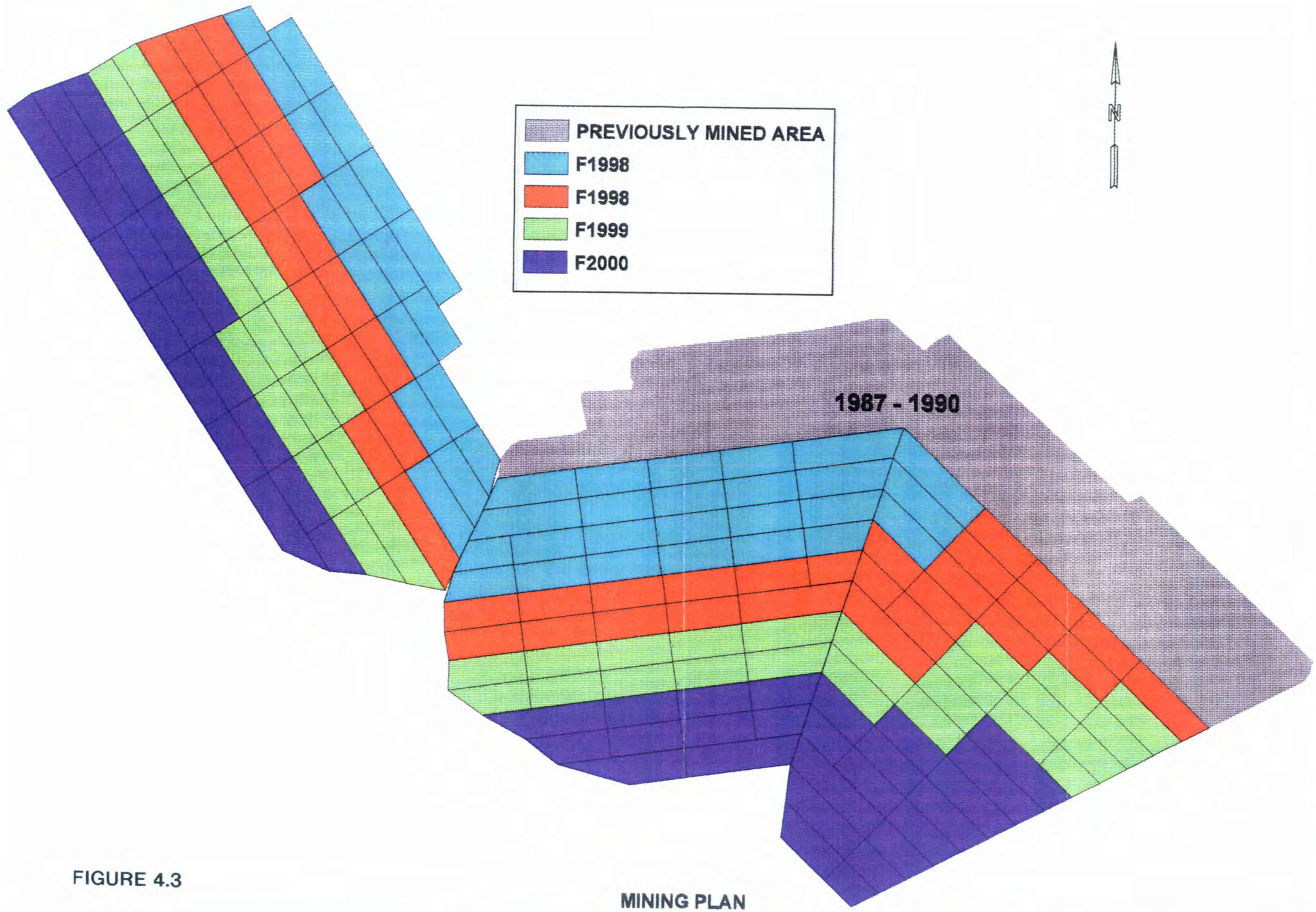


FIGURE 4.3

MINING PLAN