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Environmental impact statement for the proposed Pikes Gully colliery of Clutha Development Pty. Limited at Foybrook

PIKES GULLY COLLIERY

LIDDELL, N.S.W.

ENVIRONMENTAL IMPACT STATEMENT

LONGWORTH & McKENZIE PTY. LIMITED

EIS
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FOR THE

PROPOSED PIKES GULLY COLLIERY

OF

CLUTHA DEVELOPMENT PTY. LIMITED

AT

FOYBROOK/LIDDELL N.S.W.

PREPARED BY

LONGWORTH AND McKENZIE PTY. LIMITED

OCTOBER 1981

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1.0 SUMMARY

1.1 Introduction

Clutha Development Pty. Limited, holders of the Foybrook Colliery Holding, presently operate both an underground and an open-cut coal mine within the Colliery holding near Liddell in the Upper Hunter Valley of New South Wales. Most of the colliery surface area is owned by the Company and the southern half has been affected by surface mining where workable coal seams occur at shallow depths.

Where seams become too deep for efficient open-cut operations, underground extraction is necessary. This is most naturally carried out by establishing an entry where the seam outcrops in the high-wall left exposed in the open-cut.

The Company's existing underground operation known as Foybrook Colliery was established in this way, as illustrated in Figure 1. This mine is extracting about 600,000 T.P.A. of coal from the Liddell seam, which dips to the east. Another seam, known as the Pikes Gully Seam, dips in the same direction but occurs some 80m above the Liddell seam. The proposal outlined in this study is for a second underground mine to be established near the Foybrook Undergound mine entry, in a similar open-cut pit and high-wall, to extract the Pikes Gully Seam. This will be known as the Pikes Gully Colliery. Additionally minor modifications will be made to the Company's existing Newdell Washery to enable it to handle increasing amounts of coal from the existing Foybrook and Howick open cut mines, the Foybrook underground mine and the additional coal from the new Pikes Gully Colliery.

The Pikes Gully Colliery will be essentially the same as the existing mine, with very similar surface facilities, mining

Figure 1. View of Foybrook Colliery showing highwall and three drift entries for ventilation fan, men and materials, and coal production.

methods and coal handling processes. It is planned that it will commence operations during 1982 and is expected to recover around 440,000 tonnes run-of-mine coal per year, giving an estimated mine life of about 10 years. The coal will be trucked to the Company's existing nearby Newdell Washery and, after treatment, will be transported by rail for export through the Port of Newcastle, in the same way that coal from the existing Foybrook Mines is handled.

1.2 Assessment of Environmental Impact

It is considered that the Pikes Gully Colliery will not result in any significant impacts to the physical environment of the Colliery holding and contiguous areas. The site of the Colliery installation is in a largely modified area of former open-cut mining as shown in Figure 2 and the surface facilities will be contained within a single remaining open-cut pit and thus will be almost entirely shielded from surrounding areas.

The nearest residences and public access to the proposed Pikes Gully Colliery are in the vicinity of Hebden Road, over 1 km to the east. Although a section of conveyor gantry and storage bin will be visible from this area, no other environmental interactions are likely to occur. Air and water quality will be well protected as discussed in Sections 5 and 6 and noise from the Colliery will not cause any disturbance to residents. It should be noted that the rural acoustic character of this area is already substantially affected by current open-cut mining activities at Hebden and Foybrook.

The proposal will cause no effects on vegetation and no dislocation of native fauna or habitat. Minor surface subsidence effects may occur in some parts of privately held farmland but any damage or loss of amenity will be remedied.

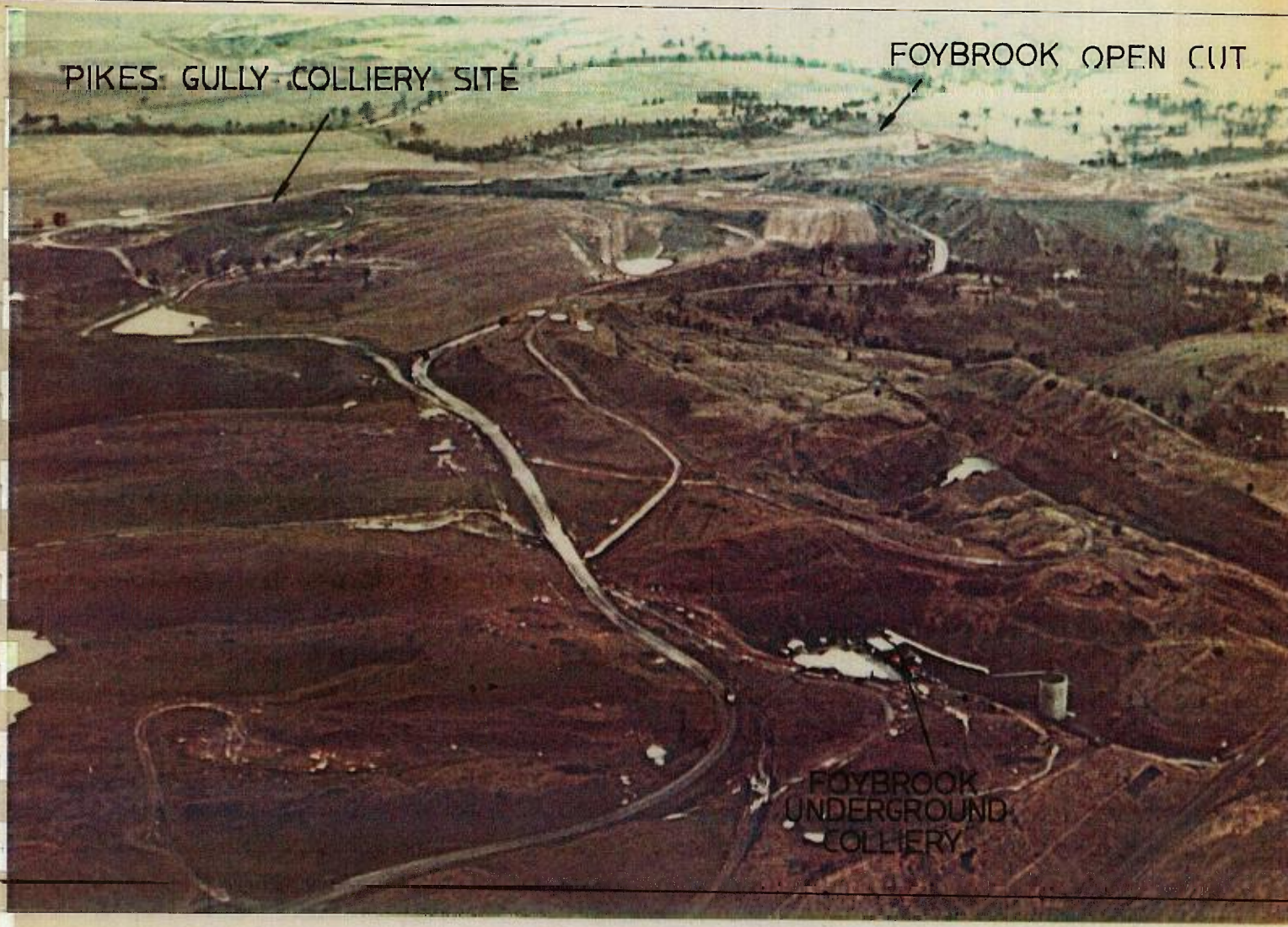

Figure 2. Aerial view looking eastwards showing existing Foybrook underground Colliery, proposed Pikes Gully Colliery and current open-cut operations within the Foybrook lease area. Foy Brook in background.

Traffic on the 5 km private haul route between the Foybrook area and the Company's coal washery will increase as a result of the additional daily coal truck movements. However, this will not cause environmental or road safety problems.

The additional 440,000 tonnes per annum of coal from the Pikes Gully Colliery that will be washed in the Company's existing Newdell washery has no adverse environmental consequences. It will not cause air or water pollution or add to stockpile sizes. Minor modifications are planned for the fines circuit of the Newdell washery, in order to handle the existing throughout from the Foybrook and Howick open cuts and the Foybrook Underground mine. This will enable the washery to handle the Pikes Gully coal also.

The number of new permanent jobs created by the proposal will be approximately 110 and thus will result in an increase in population and associated demand for housing and services in the general Upper Hunter-Singleton/Muswellbrook area. These jobs are all at Pikes Gully mine. There will be no increase in workforce at the Newdell washery.

Clutha Development will arrange for the provision of "transitional accommodation" for employees moving into the region until they are able to obtain their own houses. The Company will use its best endeavours to ensure that personnel recruited for Pikes Gully Colliery will have access to finance for home purchase. In addition, the Company will make a selection of housing available by entering firstly into agreements with Councils and land developers for the provision of land and secondly with builders for the construction of housing on that land.

The sociological and planning impacts associated with the development of Pikes Gully Colliery are the most significant consequences of the development. The cumulative effects of

this proposal, and the many other development proposals in the Hupper Hunter, will cause severe strain on available housing and urban/social infrastructure and facilities. However, it should be noted that the additional workforce for this mine that is expected to locate in the Singleton/Muswellbrook area, is small by comparison with the overall increase in population associated with current and proposed Upper Hunter regional developments.

The general Upper Hunter developments, of which the Pikes Gully Colliery forms a part, will cause enormous change to both the physical and social environment of the region. However, the Pikes Gully Colliery will be only a small part of this development.

The new colliery will enable the coal resources in the Foybrook lease area to be exploited to the maximum and will cause less disturbance of the landform than if the coal should be won by open cut means. The Pikes Gully development will contribute additional revenue to Government in the form of additional taxes and rail freights and will provide additional income to the community from the sale of the coal on the export market.

It is concluded that the social and environmental impact attributable to the Pikes Gully Colliery development including the expansion of the Newdell washery, is minimal.

Whether the Pikes Gully Colliery is developed or not, will not significantly affect the overall change occuring in the region.

2.0 OBJECTIVES OF PROPOSAL

2.1 General

The purpose of the proposed underground Colliery, to be known as Pikes Gully Colliery, is to enable soft coking coal to be mined from the Pikes Gully Seam within the existing Foybrook Colliery Holding held by Clutha Development Pty. Limited. The Pikes Gully Colliery will operate concurrently with the Company's existing Foybrook Underground mine and Foybrook open-cut which are working the Liddell and Pikes Gully seams respectively. It will enable the Company to maximise extraction of the coal reserves within the lease area.

The new underground mine is required because the depth of the coal seam, combined with easterly dip, makes this method appropriate.

The mine entry and pit-top area will be established in an existing open-cut pit and high-wall left after former surface (open cut) mining. Surface facilities will consist of a workshop, bathhouse, administration office, ventilation fan, conveyors and coal-loading bin, and will be similar to the Foybrook Underground Colliery.

An additional objective of the proposal is to increase the capacity of the Company's Newdell Washery at Liddell by minor modifications to the fines circuit. This is required to handle the projected tonnages of coal from the Company's Foybrook and Howick open cut mines, the Foybrook underground mine and the new Pikes Gully Colliery.

2.2 Alternatives

The only alternative method of extracting the coal in the Pikes Gully Seam would be by open cut methods of mining.

However, this is not practicable in this portion of the Colliery Holding and the Company propose to use underground mining methods, as stated in the preceding section.

This proposal will enable coal to be extracted from the Pikes Gully Seam within the existing Foybrook lease area in the most economic manner and with the least environmental disturbance. To achieve this, the most suitable form of mine entry to the seam which dips at 6° to the east, is by way of in-seam access from the high-wall outcrop. The proposed site for the entry and pit-top area is within a former open-cut pit with a highwall exposing the coal seam. It is easily accessible, as close as practicable to the existing coal washery, and in an area which will not alienate existing coal reserves. The topography of the site will ensure that no significant visual impact results from the proposed colliery facilities.

The proposed site is entirely suitable for the mine entry and pit-top facilities from the point of view of mining and environmental considerations. No other such sites are available within the lease area and accordingly no feasible alternatives are available to the proposed colliery site location.

2.3 Scope of Statement

This Environmental Impact Statement, which accompanies the Development Applications for the proposed colliery and coal preparation plant (washery) expansion identifies and assesses the direct and indirect environmental impacts which may result from implementation of the proposals. The statement has been prepared in accordance with the New South Wales Environmental Planning and Assessment Act, 1979, and Regulations (Ref. 1).

The statement has been prepared by Longworth & McKenzie Pty. Limited who were commissioned to carry out the investigation by the holders of the colliery holding over the area, Clutha Development Pty. Limited.

3.0 CHARACTERISTICS AND STATE OF THE EXISTING ENVIRONMENT

3.1 Location

The proposed Pikes Gully Colliery will be located about 1 km east of the existing Foybrook Underground Mine within an extensive area of former open-cut mining, some 20 km directly south-east of Muswellbrook, in the Upper Hunter Valley of New South Wales. The location is indicated on Figure 3.

The site of Pikes Gully Colliery is approximately 3 km east of Lake Liddell and about 4 km north of the New England Highway. The general area is one of major industrial development, the main features being Liddell Power Station (5 km to the west), Liddell Colliery and coal washery rail loop, Liddell State Mine, Newdell washery, Durham North open-cut, Ravensworth open-cut to the south and Hebden open-cut to the east. Figure 4 shows the study area and location of the main features.

The Newdell washery is adjacent to the Lake Liddell dam wall, and is close to the Coal & Allied Liddell coal handling complex and the Liddell State Mine. It is an existing operating coal preparation plant.

3.2 Topography

The site of the proposed Colliery and that of the existing Foybrook Underground Mine are within an extensive area of former open-cut mining which now consists of large pits and spoil heaps with relief to 50 metres. The landscape is in a disturbed and unnatural state, though re-vegetation and restoration of the surface is under way.

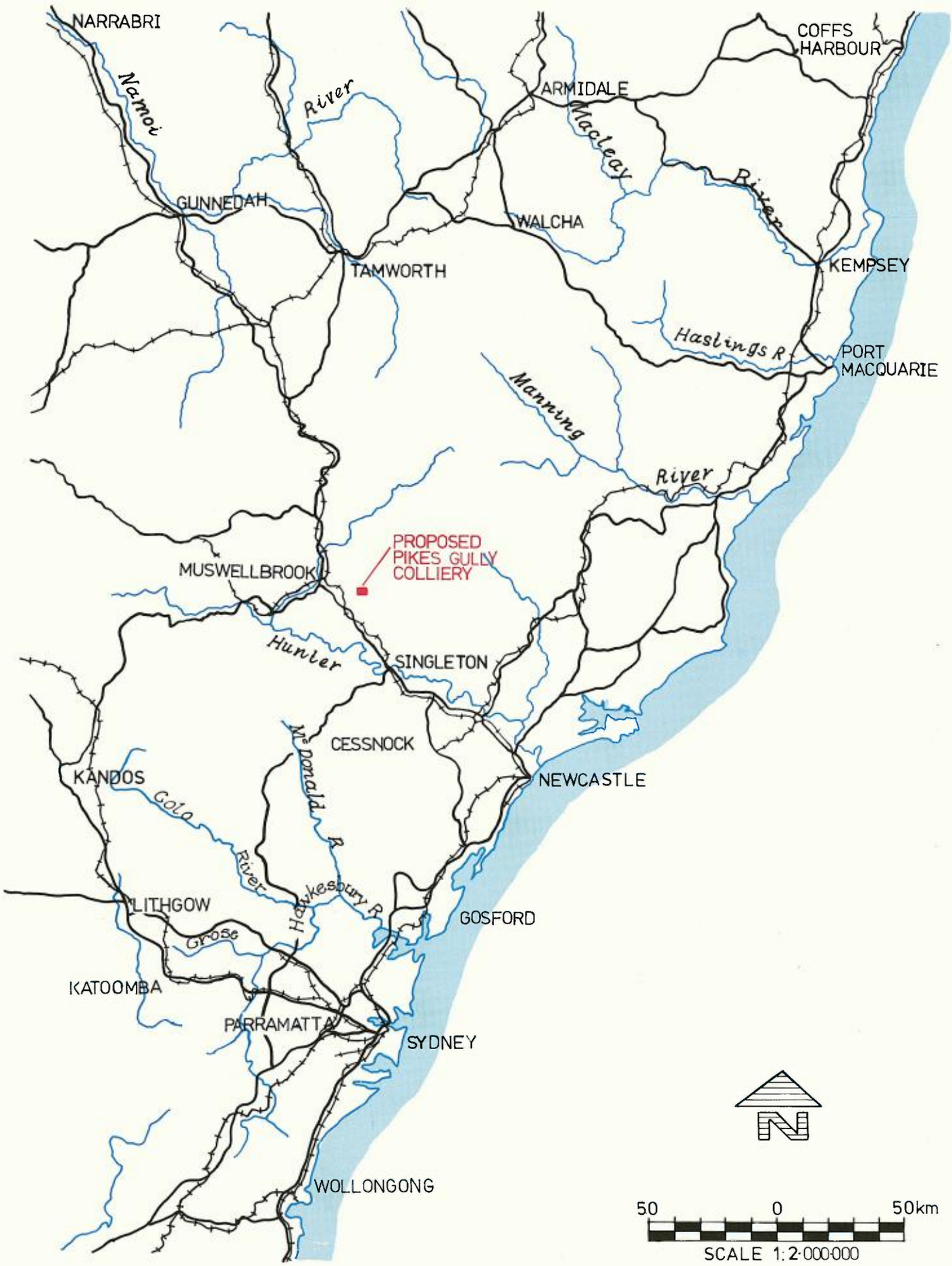

FIGURE 3 LOCATION MAP

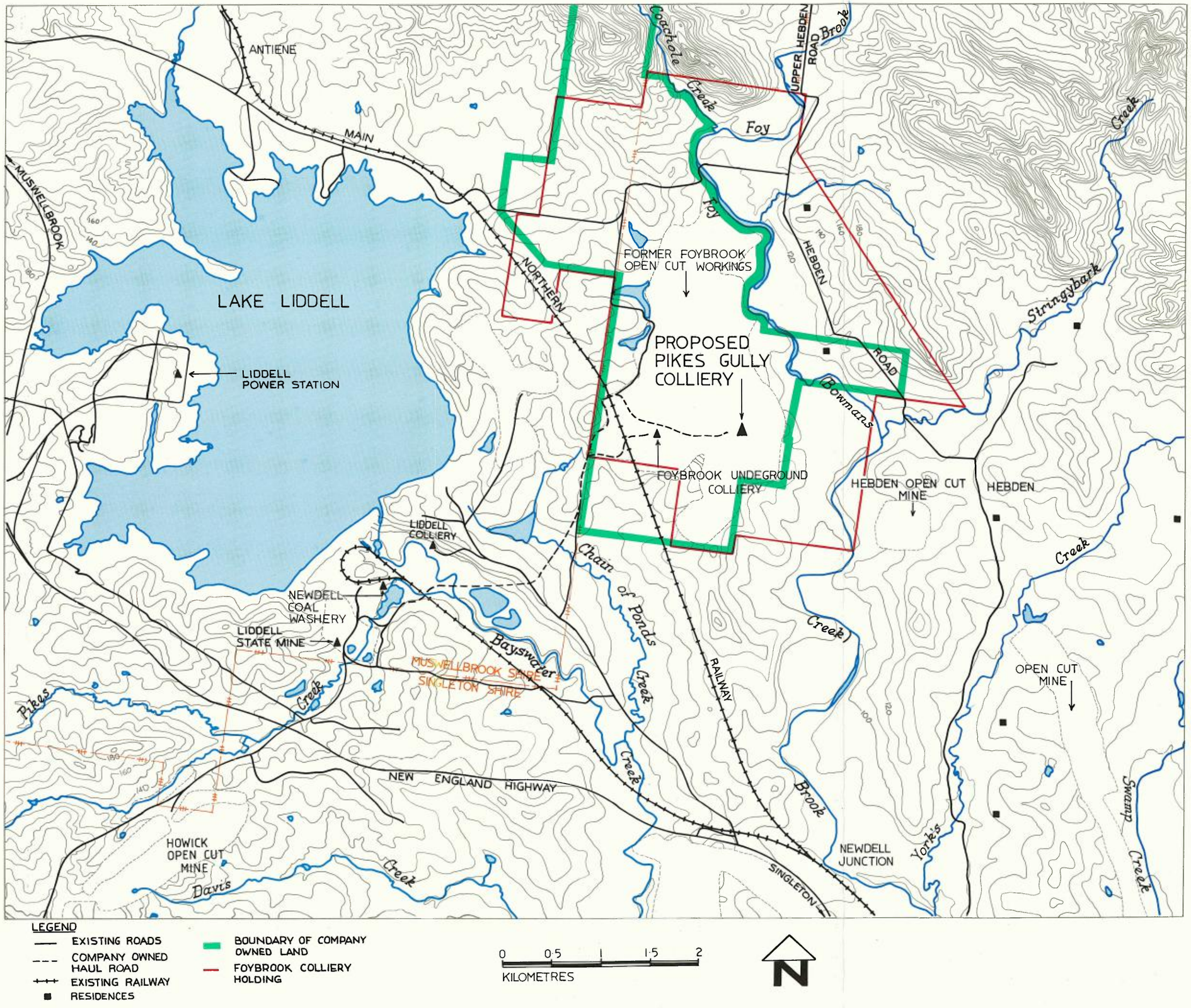

FIGURE 4 STUDY AREA

Beyond the area affected by surface mining, the landscape is one of gently undulating and largely cleared country with relief to 80 metres. Some 5 km to the north of the site the land surface is more rugged with forested hills rising to over 500m in height.

3.3 Geology

The geological sequence which outcrops in this area is part of the Singleton Coal Measures, of upper Permian age. This Group occurs extensively in the Upper Hunter Valley where it forms the north-eastern limit of the Permian-Triassic Sydney Basin. The Permian strata are folded in this area and form a series of broad anticlines and synclines. In the area of the Foybrook lease holding, the strata dips at about 6° to the east. The Hebden Fault to the north-east is the limit of the Pikes Gully Seam which can be worked from the proposed mine.

The Singleton Coal Measures typically consist of sandstone, shale, conglomerate and coal seams. The existing Foybrook Underground Mine is extracting coal from the Liddell seam. The proposed Pikes Gully Colliery will work the Pikes Gully Seam which lies about 80m above the Liddell seam.

3.4 Hydrology and Water Quality

Surface water in the area of former open-cut mining is largely contained in dams and ponds within old mining cuts. To the north-west of the disturbed area, water is collected in three large dams whereas the eastern part of the lease area is drained by Foy Brook (or Bowmans Creek), a permanent stream which joins the Hunter River some 14 km to the south.

Minor surface subsidence cracking has occurred in the bed of Foy Brook as a result of underground workings from the Foybrook Underground Mine. This caused some loss of creek

waters but the cracks have now been sealed. Groundwater is pumped from the existing Foybrook underground mine and a typical analysis is shown in Table I. The mine water likely to be encountered through mining in the Pikes Gully Seam is expected to be of similar quality. This underground mine water is diluted by surface run-off and used at Foybrook Underground Mine for bathhouse, dust suppression and fire fighting supply and also in the Newdell coal preparation plant. Discharge of the underground mine water to Bowmans Creek (Foy Brook) is permitted by the State Pollution Control Commission from a specific discharge bore at up to 25,000 Kl/day.

TABLE I. ANALYSIS OF MINE WATER FROM FOYBROOK UNDERGROUND MINE

		mg/l or value
pH		8.3
Acidity to pH 8.3	(as $CaCO_3$)	12
Alkalinity due to HCO_3	(as $CaCO_3$)	970
Chloride	(as Cl)	915
Sulphate	(as SO_4)	156
Sodium	(as Na)	1100
Potassium	(as K)	4
Iron (filtrable)	(as Fe)	<0.5
Calcium	(as Ca)	11
Magnesium	(as Mg)	12
Calcium	(as $CaCO_3$)	27
Magnesium	(as $CaCO_3$)	48
Total Hardness	(as $CaCO_3$)	75

Source: Analyses carried out by A.C.I.R.L. Laboratories in April, 1981.

3.5 Climate

Meteorlogical information is recorded at Liddell Power Station by the Electricity Commission of New South Wales (Ref. 2) and is relevant for the study area. Typical ambient conditions of rainfall, temperature and evaporation are summarised as follows:

Rainfall (April 1970 to December 1977)

Average annual rainfall	:	653 mm
Average annual number of rain days	:	74
Maximum recorded daily rainfall	:	94 mm (Feb. 1971)
Maximum recorded three day rainfall	:	110 mm (Jan. 1976)

Dry Bulb Temperature (April 1970 to December, 1977)

Mean of two-hourly values	:	16°C
Maximum recorded	:	41°C
Minimum recorded	:	2°C

Wet Bulb Temperature (March 1972 to December, 1977)

Mean of two hourly values	:	12°C

Evaporation (April 1970 to December 1977)(Class 'A' pan)

Average annual	:	1908 mm

Wind data has been measured at 8m above ground level for the period 1971-1977. This indicates that the wind direction is predominantly from the south-east (24% of the time) and north-west to west (40% of the time) with calms persisting for about 12% of the time. Seasonal wind roses are sumarised as follows:

Spring - Dominance of north-westerlies, westerlies and south-easterlies; 12% calms.

Summer - Dominance of south-easterlies with some easterlies and north-westerlies; 10% calms.

Autumn - Approximately equally distributed between south-easterlies and north-westerlies with some westerlies; 15% calms.

Winter - Dominance of north-westerlies and westerlies; 12% calms.

3.6 Air Quality

Air quality in the Upper Hunter Valley is considerably affected by discharges from Liddell Power Station, coal mining operations, road and rail transport and other minor sources.

The area of the proposed Colliery is 5 km east of Liddell Power Station and close to substantial coal mining and coal preparation, coal loading and transportation facilities. Extensive open-cut coal mining is carried out in several places surrounding the site area. Because of the presence of these major features, air quality in the study area is not that of a characteristically rural environment, though measured air quality data is not available for the site of Pikes Gully mine itself.

At Liddell, there are already extensive coal stockpile areas used by Clutha Development and Coal and Allied. Some dust emission does occur in windy weather, but does not appear to cause problems outside the coal handling areas. There are no

deposit gauges located at the Newdell washery, but visual observation, even during the recent drought does not show problems of dust nuisance or discolouration of vegetation outside the site.

A series of deposit gauges has recently been established in the Liddell - Ravensworth area by the Electricity Commission of N.S.W. However, results from these are not yet meaningful for overall air quality interpretation and quantification. No other information sources are available, though monitoring programmes are presently being established (See also Section 5.1).

3.7 Noise

The acoustic environment in the study area is not typical of that normally found in a rural setting, as a result of the substantial mining, transportation and power generation activities located nearby.

The main sources which dominate present background noise levels in the immediate vicinity of the proposed Pikes Gully Colliery are activities at Foybrook Underground Mine, the trucking of coal from this mine to the Newdell Washery, dragline operations at the Hebden open-cut mine and more distant railway and road traffic. To the west, beyond the ridge which the Liddell Colliery road follows, background noise is dominated by the coal washeries, Liddell State Mine, truck-unloading and rail-loading activities, conveyors and road and rail traffic.

In order to determine the state of the existing acoustic environment in the area surrounding the proposed Colliery, an ambient noise level survey was undertaken. The survey was carried out over two separate periods, namely the 18th - 20th February and the 19th - 20th March 1981, and included day-time, evening and late-night readings.

TABLE II. RESULTS OF AMBIENT NOISE LEVEL SURVEY (all values in dBA)

SAMPLE POINT	5-7 p.m. 18/2/81	12.30-2 a.m. 19/2/81	5.30-7.30a.m. 19/2/81	9-11 p.m. 19/2/81	9-11 a.m. 20/2/81	1-3 p.m. 20/2/81	6-7.30 p.m. 19/3/81	11 a.m.-1 p.m. 20/3/81
1 Near entrance to Hebden mining works	50	42	38	42	47	37	50	53
2. Outside Hebden Church	36	36	33	36	39	38	34	43*
3. House near Hebden open-cut	45	45	39	40	41	38	26#	41
4. Near "Hazeldene" homestead	40	43	39	40	42	34	29	34
5. Gate to "Rangaweeta"	34	36	36	37	39	36	38	49*
6. Road corner in north of area	30	43	-	-	-	-	32	37*
7. Gate on road to north	36	41	37	-	-	-	35	42*
8. Above high-wall at Pikes Gully site	37	-	-	-	47	42	31	43*
9. High point, East of Pikes Gully	44*	41	38	38	39	39	42	36
10. High-wall above Foybrook Mine	65	71	69	69	69	69	67**	64**
11. Foybrook mine office	67	61	67	67	66	65	55**	53*
12. Beside house on road to west	52	41	45	46	41	45	39**	47**

* Wind affected readings.

** Not all noise sources operating as mine workforce on strike.

#Without open-cut operations

All readings were taken using a Bruel and Kjaer Precision Sound Level Meter, Type 2218, which was calibrated and checked using a Sound Level Calibrator Type 4230 before each set of readings. Weather conditions varied and the heavy rain which interrupted the initial survey made the second survey necessary. Readings were taken however, without the effects of wind or rain noise, except where noted.

Background noise levels were measured at twelve sample points in the area of the proposed Colliery and surroundings, particularly near residences, the closest of which is over 1 km east of the site. The locations of the sampling points are shown on Figure 5. and the results obtained given in Table II.

The results indicate that even in the remotest parts of the area studied (sample points 2,4,5,6,7) background noise levels do not fall below approximately 30 dBA and are mostly between 35 and 40 dBA at all times of the day and night. This includes the immediate vicinity of the proposed Colliery site (point 8). However, levels are much higher around Foybrook Underground Colliery (points 9,10,11) and to the west where the major noise sources are closer (point 12) and in the east near the Hebden open-cut operation (points 1 and 3).

3.8 Flora and Fauna

The area surrounding the proposed Pikes Gully pit-top is a disturbed and unnatural landscape, produced by the excavation of large pits and the formation of spoil heaps during former open-cut mining operations. Accordingly, the vegetation in much of this area consists only of grass cover with some small shrubs, though some taller trees remain in parts which were not mined.

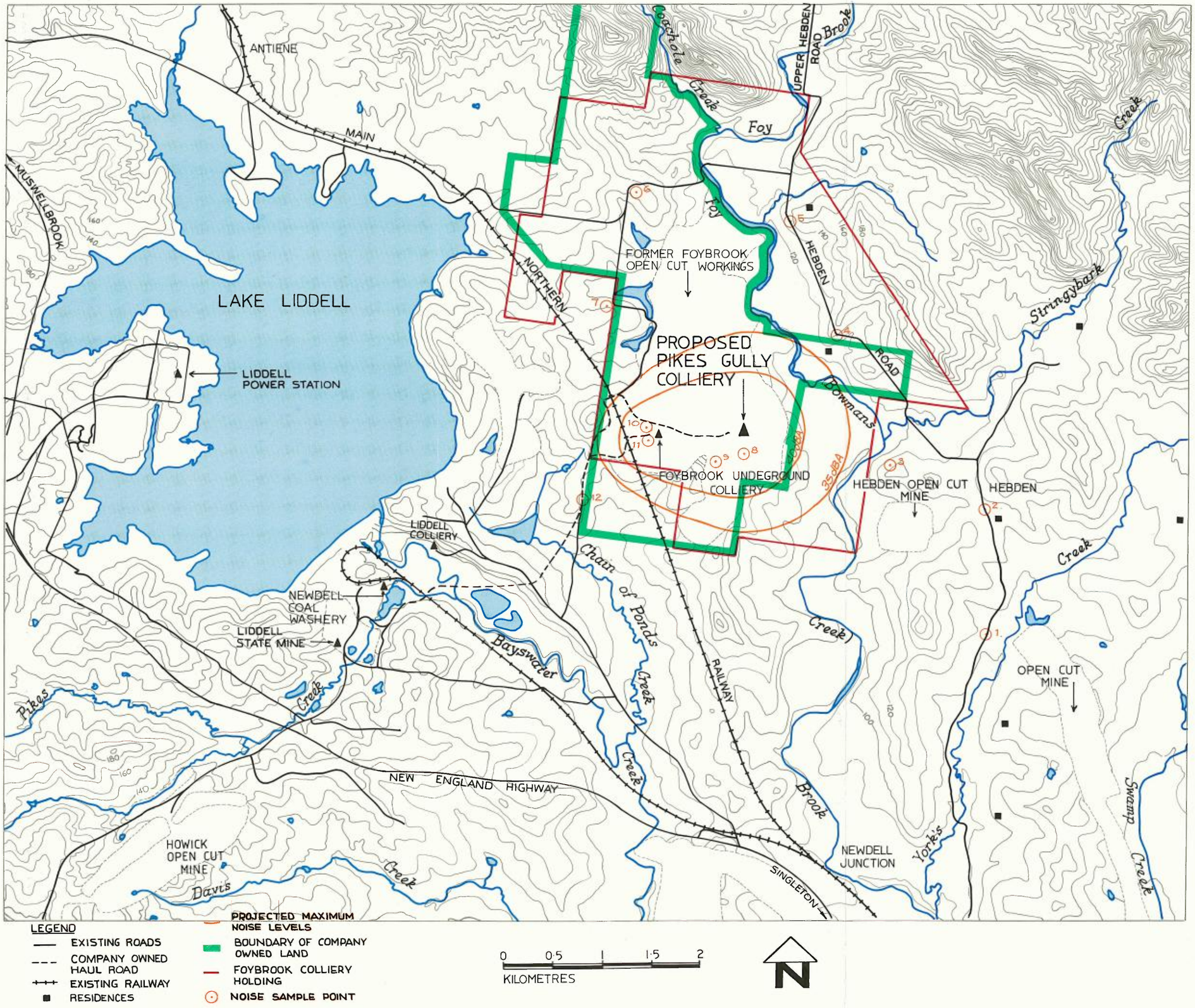

FIGURE 5 NOISE SAMPLE POINTS AND PROJECTED NOISE CONTOURS

Beyond the limits of the open-cut operations, most of the flat and undulating land in the lease area has been cleared for agricultural and grazing purposes and only a grass cover remains with some ploughed fields. Some trees, mainly tall eucalypts, have been left standing, particularly along the course of Foy Brook. On the steeper slopes several kilometres to the north of the site, substantial areas of woodland and natural forest remain.

The area surrounding the proposed Colliery facilities was examined by an ecologist to assess its significance in terms of native fauna. However, no evidence was found to suggest the presence or use of this area by native animals, due largely to the altered state of the land surface and the lack of natural vegetation.

3.9 Visual Amenity

The landscape in the vicinity of the proposed Colliery has been substantially altered by extensive open-cut mining in the past. Much of the surface consists of large open-cuts and areas of heaped overburden which have been graded and which are in the process of being rehabilitated.

The mined area is essentially unattractive when viewed both close-up, near the existing and proposed Collieries, and from a distance of 1 to 2 kilometres on the Hebden Road to the east.

The actual site of the proposed Pikes Gully underground entry and surface facilities is, like the Foybrook Undergound Mine, fully contained within a large former open-cut and, as such, will be visible only in the immediate vicinity. The open-cut is shown in Figure 6.

3.10 Traffic Conditions

The roads in the immediate vicinity of the Pikes Gully site are not public roads and are currently used only by Company vehicles associated with mine development, open-cut activities and washery reject disposal. However, the sealed road between Foybrook No. 1 Mine and the Company's Newdell Coal Washery, near Liddell Colliery, is heavily used by coal trucks as well as general mine traffic. This traffic averages 300 truck movements per day and 100 light vehicle movements. The route used by the coal trucks crosses the Old New England Highway which is now closed off by Lake Liddell and carries no traffic except vehicles requiring access to the Liddell Coal activities.

3.11 Land Use and Ownership

The surface land contained within the Foybrook colliery holding is owned partly by Clutha Development Pty. Limited and partly by individual landowners. The site for the establishment of surface facilities and mine entry at Pikes Gully is owned by Clutha Development Pty. Limited.

In the eastern part of the colliery holding along Foy Brook and the Hebden Road, the land is largely cleared and used for grazing purposes, with some cultivation along the low-lying flat sections. Around Hebden, open-cut mining is carried out by the Hebden Mining Company on a separate lease holding.

The land owned by Clutha Development Pty. Limited is shown in Figure 4.

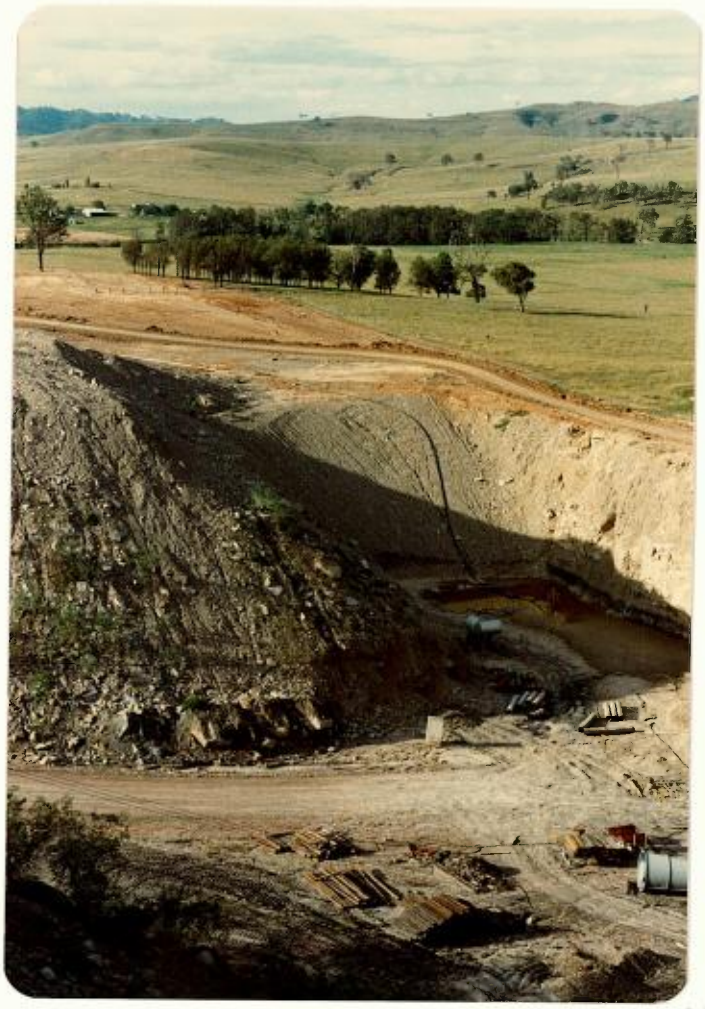

Figure 6. Former open-cut which will contain Pikes Gully Colliery, showing outcropping coal seam and position of stormwater dam.

3.12 Planning Context

The existing Foybrook Colliery and the proposed Pikes Gully development are both within Singleton Shire. However, the Shire boundary follows the north-south access road as shown on Figure 4 and all land and facilities west of this road, including the Company's Newdell coal washery, are within Muswellbrook Shire.

A detailed sociological and demographic analysis has been carried out in order to fully understand the existing socio-economic framework within the Muswellbrook-Singleton area.

For the purposes of this study data has been organised on the basis of the current local Government Areas.

Tables III and IV show, respectively, the population of the two Shires of Singleton and Muswellbrook in five-year age cohorts from 1933 to 1976. The economic base of the two shires is historically agricultural. Early coal mining took place in the 1930's and in 1952 further mining at Liddell and Foybrook was commenced. The expansion of the army depot (Singleton) in the mid 1960's was a further factor adding diversification to the economic base. In the late 1960's Liddell Power Station was commenced and a new power station at Bayswater, which is adjacent, is now under construction, and is due for completion in 1986. The massive expansion of coal mining in the region commenced in the mid 1970's.

The impact of these developments is clearly demonstrated in Tables III and IV. In the case of Singleton, the 1952 coal developments are expressed in the rise in the 20-34 and 40-44 age cohorts where the number of males increased significantly whilst the number of females in the same cohorts increased to

a lesser degree (suggesting an immigration of single men). There was also an increase in the number of children in the 0-19 age cohorts. The impact of the expansion of the army depot is very pronounced in the 20-24 male cohort for the 1966 and 1971 census and the emergent growth in coal mining and power generation is strongly demonstrated in the 1976 census which shows rises in all male cohorts 0-44, but only in female cohorts 25-39, again indicative of the significant number of single men attracted to these new elements of the economic base.

Muswellbrook differs from Singleton in several significant respects. The opening of the coalmines in 1952 is clearly demonstrated in the increase in the 20-44 age cohorts for both males and females (again males dominate but to a lesser degree than in Singleton). The 1961 census shows a loss of population, particularly in the 15-24 age cohorts, suggesting that Muswellbrook was reverting to a typical rural town where this phenomenon is commonplace - reflecting the out-migration of school leavers in search of job opportunities elsewhere.

By 1966, this process was reversed and the 1971 census clearly demonstrates the massive influx associated with the construction and opening of Liddell Power Station and the extension of coal mining. It is notable that both male and female age cohorts from 0-49 show an increase with the heaviest concentration in the 20 -39 age cohorts. As with Singleton this growth is significantly skewed to males. In contrast, the 1976 census indicates a loss in the 10-49 age cohorts of both sexes which suggests that much of the

TABLE III SINGLETON (SHIRE) 5 YEAR AGE COHORT 1933 - 1976

Note: Singleton Shire = Patrick Plains Shire + Singleton Municipality

	YEAR	1933		1947		1954		1961		1966		1971		1976		1933	1947	1954	1961	1966	1971	1976
	Population	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	TOTAL	T	T	T	T	T	T
Item																						
0 - 4		501	525	498	481	569	582	607	586	623	552	576	598	655	594	1026	979	1151	1193	1175	1174	1248
5 - 9		546	491	412	367	557	520	553	557	594	584	656	589	587	652	1040	779	1077	1110	1178	1245	1239
10 - 14		500	525	391	469	433	465	474	553	523	579	600	615	712	612	1025	860	898	1027	1102	1215	1324
15 - 19		553	527	405	495	407	348	412	422	452	482	492	533	651	548	1080	900	755	834	934	1025	1199
20 - 24		511	489	369	326	377	401	306	286	772	325	947	450	542	429	1000	695	778	592	1097	1397	971
25 - 29		452	366	312	288	409	352	326	312	335	275	476	363	511	476	818	600	761	638	610	839	987
30 - 34		368	344	341	319	365	351	379	344	334	313	331	317	479	385	712	660	716	723	647	648	864
35 - 39		297	325	286	295	348	317	332	282	373	326	331	320	387	329	622	581	665	614	699	651	716
40 - 44		282	294	296	289	344	308	305	303	342	289	353	341	346	293	576	585	652	608	631	694	639
45 - 49		273	244	273	261	301	267	290	260	300	274	328	266	321	336	517	534	568	550	574	594	657
50 - 54		247	207	226	240	285	256	281	261	287	243	283	249	289	251	454	466	541	542	530	532	540
55 - 59		202	197	207	199	222	212	229	208	248	255	261	228	272	242	399	406	434	437	503	489	514
60 - 64		184	173	176	185	175	202	189	213	211	192	189	217	206	234	357	361	377	402	403	406	440
65 +		355	328	419	436	429	471	421	480	407	552	406	548	412	610	683	855	900	501	929	954	1022
Not stated		8	3	7	11	-	-	-	-	-	-	-	-	-	-	11	18	-	-	-	-	-
TOTAL		5279	5051	4618	4661	5221	5055	5104	5067	5801	5211	6229	5643	6370	5989	10330	9279	10276	10171	11012	11863	12359

TABLE IV POPULATION BY 5 YEAR AGE COHORTS:

SHIRE OF MUSWELLBROOK (corrected) 1933 - 76

	1933		1947		1954		1961		1966		1971		1976	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F
0 - 4	433	390	473	373	600	558	567	526	585	572	644	650	605	574
5 - 9	385	398	353	336	552	496	525	504	543	525	652	647	639	616
10 - 14	373	376	356	324	447	395	498	459	532	447	607	548	585	614
15 - 19	382	297	379	318	405	318	486	334	506	422	565	442	549	494
20 - 24	416	313	354	278	423	350	309	300	429	334	510	500	476	404
25 - 29	326	255	301	246	431	344	305	285	358	334	562	444	456	440
30 - 34	234	256	286	258	363	336	336	299	347	285	453	360	435	413
35 - 39	251	213	307	250	343	304	320	297	369	301	396	308	369	365
40 - 44	240	201	260	205	343	280	292	283	313	277	394	335	360	280
45 - 49	232	181	239	193	283	248	310	255	285	273	341	284	343	295
50 - 54	170	140	216	141	214	177	267	243	301	232	278	260	274	264
55 - 59	110	112	168	147	191	146	190	150	241	220	282	207	235	205
60 - 64	119	101	135	117	153	114	163	138	156	138	192	277	233	185
65 +	201	160	231	233	278	284	286	304	333	344	336	391	333	485
Not stated	5	2	30	26										
TOTAL	3887	3395	4085	3445	5026	4350	4867	4381	5298	4704	6208	5563	5888	5632

employment associated with this development, particularly in the construction field, is ephemeral in terms of its impact. No doubt post-1976 activity will have reversed this population decline.

Table V and VI indicate the industry of the workforce between 1933 and 1976 for the two local government areas.

In the case of Singleton, the over-riding characteristic is the decline in the number engaged in agriculture (from 1900 in 1933 to 1100 in 1976) despite the increasing number of women employed in agriculture (possibly reflecting the rise in family farming Companies). The decline in males employed in agriculture is very dramatic. Those engaged in mining increased significantly in 1954 (following the opening of the new coal mines), increased again in 1971 and increased dramatically in 1976. The number engaged in manufacturing was relatively stable throughout the period whilst those in public utilities rose significantly in 1971 and 1976 (reflecting the establishment of Liddell Power Station). Surprisingly, the number in construction remained fairly stable as did the transport sector. The number in the commerce category (wholesaling and retailing) increased significantly, attributable entirely to a substantial rise in the number of females employed in this category. The growth in this category can be directly co-related with growth in the basic sector of employment (that is, a combination of agriculture, mining, manufacturing, electricity generation and defence). The dramatic rise in the number employed in the public authority and defence category from 1966 onwards reflects the upgrading of the army depot and masks a rise in public authority employment. There is also a significant rise in community services, again dominantly female employment, which is consistent with elsewhere. In contrast the decline, allbeit relatively minor, in entertainment/hotels is atypical.

TABLE V SINGLETON (SHIRE) POPULATION BY INDUSTRY 1933 - 1976

Item	YEAR	1933		1947		1954		1961		1966		1971		1976		1933	1947	1954	1961	1966	1971	1976
	Population	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	TOTAL	T	T	T	T	T	T
1)	Agriculture	1814	91	1433	114	1291	86	1176	115	1033	219			734	346	1905	1547	1377	1291	1252		1080
2)	Forestry	21	-	41	-	27	-	19	-	24	-	870	78	-	-	21	41	27	19	24	948	-
3)	Fishing, Hunting	21	-	50	-	4	-	1	-	-	-			8	2	21	50	4	1	-		10
4)	Mining, Quarrying	29	-	67	-	292	4	221	1	244	2	361	5	613	11	29	67	296	222	246	366	624
5)	Manufacturing	213	24	244	97	264	39	248	25	258	43	228	40	179	44	237	341	303	273	301	268	223
6)	Electricity, Gas, Water	8	-			60	-	64	3	71	5	141	3	184	6	8	-	60	67	76	144	190
7)	Construction	454	-	218	1	386	-	268	1	345	7	342	9	328	20	454	219	386	269	352	351	348
8)	Transport & Storage	226	11	243	20	181	14	178	3	174	12	124	12	148	21	237	263	195	181	186	136	169
9)	Communication	32	14	25	14	45	27	60	25	55	39	43	29	39	24	46	39	72	85	94	72	63
10)	Commerce			271	103	368	157	348	149	355	200	412	254	385	274	366	374	525	497	555	666	659
11)	Finance & Property	334	72	41	5	40	11	44	15	44	22	77	38	69	104	40	46	51	69	66	115	173
12)	Pub. Admin, Defence	112	133	116	149	250	193	149	10	648	50	882	72	619	89	245	80	220	159	698	954	708
13)	Community Services	51	309					115	178	133	243	127	281	127	288	360	185	223	293	376	408	415
14)	Entertainment hotels	13	1	73	175	85	140	64	118	66	154	55	167	55	141	14	248	225	182	220	222	196
15)	Other	330	246	134	24	21	11	70	59	27	40	144	37	131	148	576	158	32	129	67	181	279
16)	Unemployed	-	-	-	-	-	-	-	-	-	-	17	6	-	-	-	-	-	-	-	23	-
17)	Total Workforce	3665	902	2968	703	3314	682	3045	681	3577	1039	3807	1171	3619	1516	4567	3671	3996	3726	4616	4978	5135
18)	Total Population	5279	5051	4618	4661	5221	5055	5104	5067	5801	5211	6229	5634	6370	5989	10330	9279	10276	10171	11012	11863	12359

Source: Australian Bureau of Statistics

Note: Totals have been disaggregated by interpolation to obtain continuous series for all workforce categories.

TABLE VI INDUSTRY OF THE WORKFORCE, SHIRE OF MUSWELLBROOK

(corrected for all census years)

	1933		1947		1954		1961		1966		1971		1976	
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
Agriculture	1084	39	782	41	905	62	799	60	744	140			604	266
Forestry	11	-	14	-	1	-	11	-	11	-	735	148	2	-
Fishing,Hunting	65	-	47	-	8	-	3	-	1	-			-	-
Mining,Quarrying	167	-	363	4	525	9	360	7	296	7	318	9	465	8
Manufacturing	142	23	158	32	350	57	283	43	355	59	313	65	282	97
Elec.Gas,water supply	12	-	-	-	39	2	100	2	22	14	390	27	463	24
Construction	323	-	359	1	308	1	293	4	550	6	709	21	245	20
Transport,Storage	158	9	274	28	297	26	265	13	219	19	166	26	175	31
Communication	22	7	19	16	48	21	54	18	66	30	50	37	64	38
Commerce	228	45	192	71	277	120	284	134	323	213	416	266	362	277
Finance,Property	20	4	27	7	34	13	41	16	51	22	82	73	86	73
Public Authority and Defence	87	74	136	79	156	124	89	11	105	17	148	43	185	66
Community services	44	130	82	63	91	78	114	156	133	202	124	222	147	283
Entertainment, Hotels	22	-	36	70	39	68	102	113	99	128	92	164	102	147

Source: A.B.S.

Muswellbrook demonstrates similar general characteristics to Singleton but differs in significant respects. The decline in employment in agriculture is less marked than Singleton. Employment in mining is long established, increased in 1954 (following the opening of new mines at Liddell in 1952), declined to 1966 and rose significantly in 1976. Employment in electricity generation increased substantially in 1971 and 1976 following the opening of Liddell Power Station and it is evident that some 75% of Liddell employees live in Muswellbrook. Similarly the construction workforce associated with Liddell concentrated in Muswellbrook and is expressed in the doubling of employment in this category in 1966 and 1971.The construction of Bayswater Power Station and the Liddell expansion will presumably have the same effect.

Whilst in 1933 more people were employed in commerce in Singleton than Muswellbrook, the two centres exhibited near-identical characteristics in 1976, suggesting that the two towns are now similar. However the greater rate of growth in employment in the non-basic sector of employment in Muswellbrook suggests that a wider range and slightly higher level of services are now available in that town. For instance, the greater rate of growth and the higher absolute employment in the Finance and Property, Community Services, Entertainment and Hotels (and it may be surmised in the Public Authority), categories of employment reinforces that view. This is despite the fact that the assumed total basic employment in Muswellbrook is less than in Singleton.

Muswellbrook extends an influence over a wider region (including, for example, the Shire of Merriwa) and this may account for its greater concentration in non-basic, or service, industries. It is significant for instance, that employment in the commerce category in Muswellbrook rose in 1954, 1966 and 1971, all years in which sectors of basic

employment also rose significantly and declined in 1976 paralleling a decline in basic employment.

TABLE VII BASIC AND NON-BASIC WORKFORCE, SINGLETON AND MUSWELLBROOK

		1933	1947	1954	1961	1967	1971	1976
Singleton	basic	2221	2040	2067	1873	2488	2524	2614
	non-basic	2346	1631	1929	1853	2128	2454	2521
	ratio	1.06	0.80	0.93	0.99	0.85	0.97	0.96
Workforce participation rate %		44.2	39.56	38.88	36.63	41.91	41.96	41.55
Muswellbrook	basic	1543	1441	1956	1668	1705	2053	2234
	non-basic	1659	1648	1723	1975	2347	2808	2513
	ratio	1.08	1.14	0.88	1.18	1.38	1.37	1.13
Workforce participation rate %		43.97	41.02	39.24	37.45	40.51	40.95	41.20

Table VII shows the relationships between basic and non-basic, or service sector, jobs. For this exercise basic employment includes agriculture, mining, manufacturing and public utilities including electricity generation and defence. All other categories of employment, that is construction, transport, communications, commerce, finance and property, public authority, community services and entertainment/personal services are regarded as being jobs that are required to support the basic sector. In fact, there will be some jobs in the basic sector that will support the local population (eg. food production) and others in the non-basic sector that will have a dominantly 'export' function (e.g. tourism, construction etc.). It is considered that any imperfections in the division adopted will cancel

each other out and that the inferences to be drawn from the analysis will be accurate within 10%.

It should be noted from the 1933 figures (when agriculture was the dominant economic base activity of the region) that the basic/non-basic ratio was about 1:1.08. That is, for every basic job there were 1.08 non-basic jobs. It would be expected that the ratio of non-basic jobs would have risen with the emphasis on public service and welfare activities, on consumerism and personal services.

This is partly evident in Muswellbrook where an upward trend is evident, however in this case the increase in the ratio of non-basic to basic jobs was twice arrested; firstly in 1954 which followed the opening of the new mines and secondly, in the late 1960's coincidental with the development of Liddell Power Station and associated new coal mines. This suggests something of a time-lag in the development of the non-basic sector extending certainly to ten years and possibly to fifteen years.

This phenomena is partly evident in Singleton where the basic/non-basic ratio has not exceeded 1:1 since 1933. It is possible that the inclusion of the defence personnel in the basic sector accounts for this since that category of employment may have less of an impact on certain categories of non-basic employment than normal civilian employment (in that certain services such as entertainment, education and personal services, such as hairdressing, are included within the defence personnel category).

Taking the two sets of figures into account, it is considered reasonable to predict that each new basic job will generate 0.75 jobs in the short term, increasing to 1.0 jobs after five years, 1.25 jobs after ten years and 1.50 jobs after fifteen years. It may also be inferred from the population

data that the population is more masculine than is usual and that significant deficiency in the female age cohorts 20-49 may account for the retardation in the generation of the non-basic sector jobs. It is noteworthy that females have contributed the major component of growth in service sector employment.

4.0 DESCRIPTION OF PROPOSAL

4.1 General

The Pikes Gully Colliery development will consist, essentially, of a mine entry and pit-head facility with workshop, bath-house, office, ventilation fan, and a coal storage bin and truck-loading facility. The arrangement, which is shown in Figure 7, will be very similar to that at the Company's existing Foybrook Underground Mine nearby, with both Collieries being established within former open-cuts where the coal seam being worked is exposed in the high-wall.

Three separate in-seam entries will be established for men and materials access, coal production and return ventilation, as is presently the case at Foybrook Underground. Mining will be carried out using the bord and pillar method and the new mine will work the Pikes Gully Seam which lies some 80m above the Liddell seam, which the Foybrook Undeground Mine is working and which dips in the same way at 6° to the east. Approximately 440,000 tonnes of coal per year will be transported to the Company's Newdell Washery by truck and after washing will be transported by rail to the Port of Newcastle for export.

At the planned production rate of 440,000 tonnes/annum of Run-of-Mine coal, Pikes Gully Colliery is estimated to have a life of some ten years only from 1982-1992. It is the policy of Clutha Development to establish small underground mines as the coal seams become too deep to be mined economically by open cut methods. When Pikes Gully Colliery is worked out, it is planned that another similar mine will take its place and the workforce will be able to transfer there.

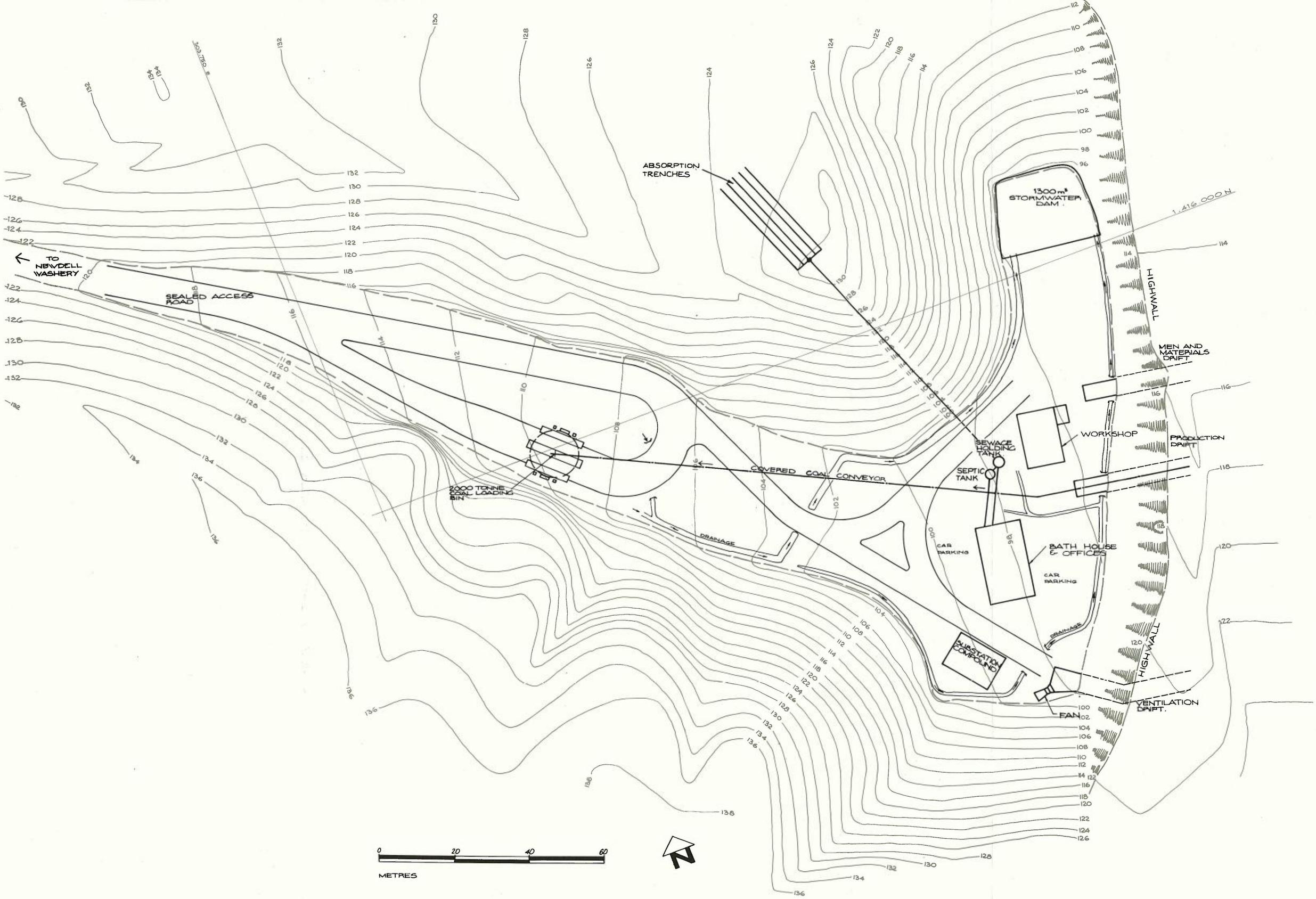

FIGURE 7 PROPOSED SITE LAYOUT

The Foybrook Underground Mine is not in this category and is planned to continue in production after Pikes Gully is closed and for some considerable additional time due to another coal seam below the Liddell seam which is not now being worked.

4.2 Access

The Pikes Gully site is presently accessible by way of a sealed road, leading from the main Foybrook open cut access road. The actual mine entries and pit-top facilities will be contained within a large former open-cut. The present sloping access road will be widened and sealed to enable coal trucks to enter and turn into the loading bin facility.

4.3 Site Preparation and Construction

The proposed Colliery pit top facilities will be contained within a large open-cut which exposes a high-wall suitable for the mine drifts. The present sloping access track into the pit will be widened and sealed and earthworks carried out to ensure the walls are stable. Roadways and vehicle turning areas will be laid out as shown in Figure 7 and will be entirely sealed. Stormwater drains will be installed around the perimeter of the area, at the base of the walls and will lead to a 1300 cubic metre capacity dam to be constructed at the northern end of the cut, as shown in Figures 6 and 7. All surface drainage around the colliery pit top area will be enclosed within this area and will be drained to the 1300 cubic metre dam. Excess stormwater and any contaminated surface water, (excluding sullage and sewage), draining from the pit top area collected in the dam will be pumped from the dam/sump in the corner of the mine site to other adjacent open cuts. Mine water will also be removed in a similar way, as discussed in Section 4.6.

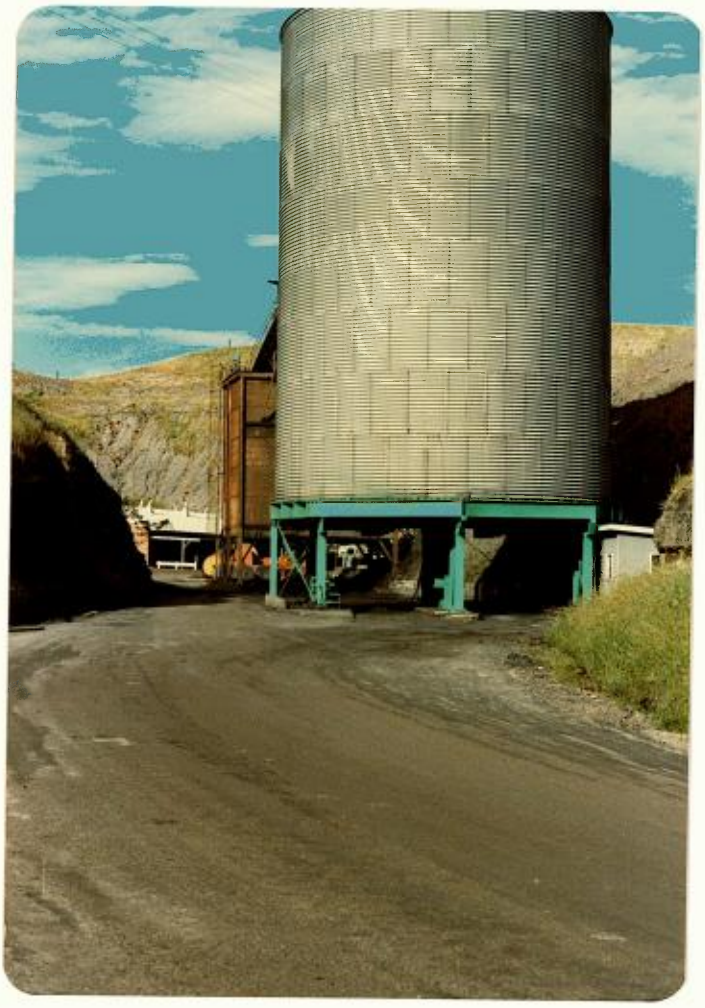

Figure 8. Coal storage bin and truck loading facility at Foybrook Colliery.

The workshop will be constructed with steel frame and cladding on a concrete slab base. The bath-house and office block will consist of high-class transportable units on brick piers. These will be removed to another site when the mine ceases production.

Effluent from the bath-house will be collected in a septic tank and holding tank within the pit area. From here it will be pumped to a series of absorption trenches above and beyond the immediate pit area.

A 2000 tonne capacity steel bin will be constructed at the pit top and will be similar to the one at Foybrook, as shown in Figure 8. This bin will accept coal from the mine conveyor. Trucks taking coal to the Company's Newdell Washery will enter the pit top area and turn in under this bin where they will be loaded ready to carry the run-of-mine coal to the washery.

4.4 Coal Mining

4.4.1 Coal Resources

The Pikes Gully Seam contains a high quality soft coking coal but its extent is limited by the Hebden Thrust to the north east. This major geological fault has caused the Singleton Coal Measures, including the Pikes Gully Seam, to abutt the older non-coal bearing rocks of the Maitland Croup.

A total of 8.8 million tonnes of in-situ coal is thought to exist in the Pikes Gully Seam within the lease area and it is considered that about one half of this is recoverable. This suggests a mine life of about 10 years based on an annual production rate of 440,000 tonnes.

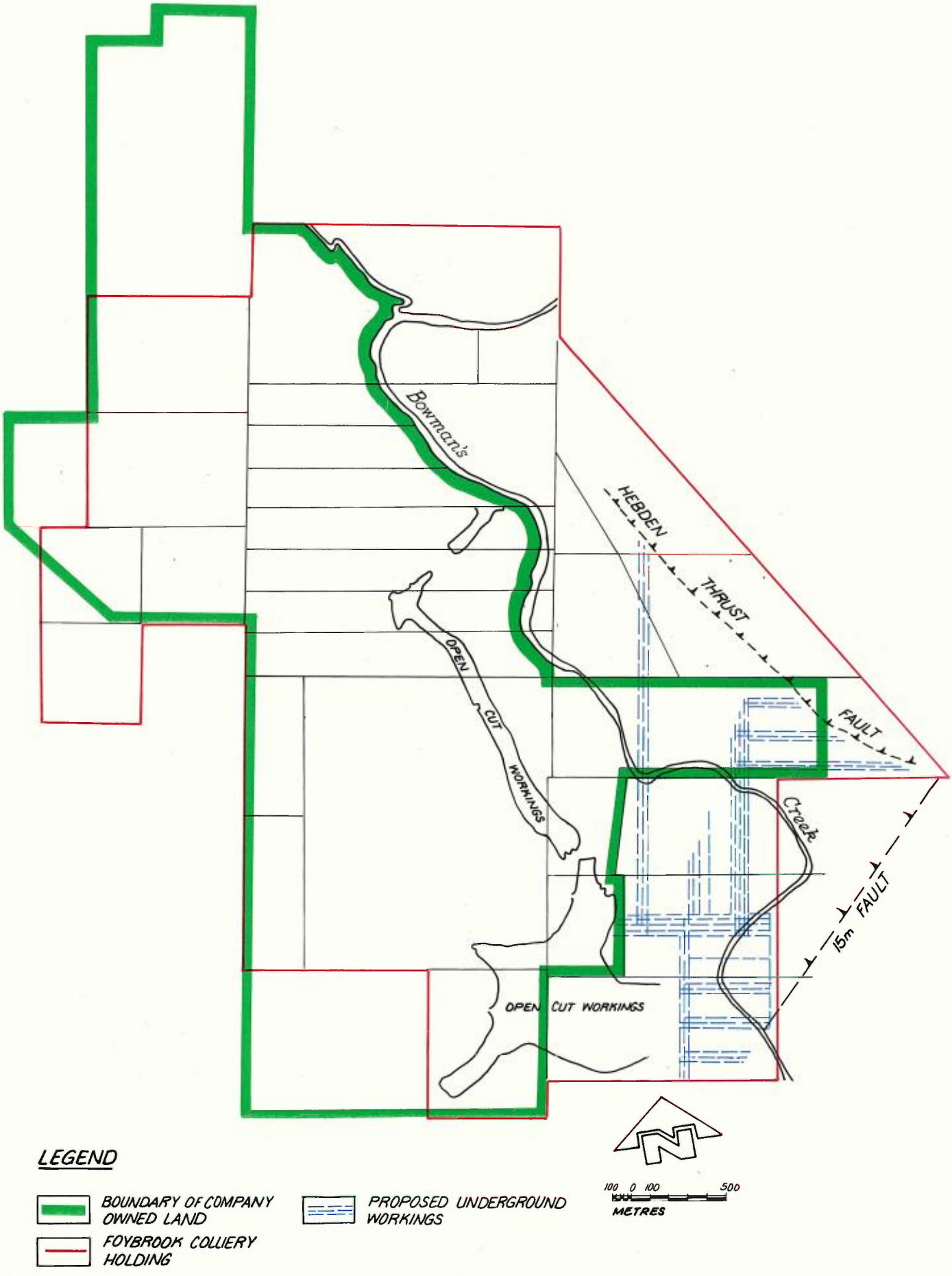

FIGURE 9 PROPOSED MINE DEVELOPMENT AND CONSTRAINTS

Figure 9 shows the proposed underground mine development and the constraints affecting the proposal.

4.4.2 Mining Operations

It is planned to mine the Pikes Gully Seam using the bord and pillar method which is currently used in the existing Foybrook Underground Mine and in other underground mines in the area. Total extraction, or the removal of support pillars will only be carried out where surface features or structures will not be affected by subsidence.

Coal will be mined by continuous miners and carried by electric shuttle cars to conveyors to be taken out of the mine to the 2000 tonne product bin.

4.5 Product Handling and Transport

Coal will be removed from the mine by an electrically-driven conveyor system and held in a cylindrical 2000 tonne capacity steel storage bin. This will also serve as a direct loading facility for 22 tonne capacity coal trucks which will carry the raw (run-of-mine) coal to the Company's Newdell Washery on the existing road system in the same way that coal from Foybrook Underground Mine is handled.

After washing, the coal will be loaded on to rail wagons at the Liddell rail loop and carried to Newcastle for loading and export by sea. This is considered to be by far the most satisfactory coal transport option as the only road haulage involved is on the Company's private road between pit-top and washery. This system is in line with the Government's objectives of using rail transport for coal wherever possible.

4.6 Newdell Coal Preparation Plant (Washery)

The Newdell Coal Washery is located close to Lake Liddell and the rail loading loop, about 5 km by road from Pikes Gully.

The modifications to the coal washery, which are proposed, are minor. They comprise increase in kilowattage (power) of the same conveyor drives, increase in some pump capacities and the installation of a new Enviroclear thickener, about 8 m. in diameter, outside the washery building, as shown on Figure 10. All modifications are confined to the fines circuit of the washery. With the exception of the new Enviroclear thickener, there will be no outside modifications and there will be no alterations to the washery building.

Similarly all conveyor gantries will remain unaltered and it is NOT expected that coal stockpiles will increase in size.

The Newdell coal preparation plant has the capacity to wash the estimated 440,000 tonnes of coal per year from the Pikes Gully Colliery in addition to its current throughput from the Company's other mines in the area.

4.7 Water Management

A schematic water management plan for the Pikes Gully Colliery is shown in Figure 11. Underground mine water will pumped directly from the workings up to the dam adjacent to the access road to the pit top area. Surface water run-off from the pit top area, which will contain suspended coal and possibly oil and other contaminants will be drained by gravity into the storm water retention dam adjacent to the highwall in the pit top area.

Surface run-off water, after primary settlement in the collecting dam within the pit top area will be pumped up the

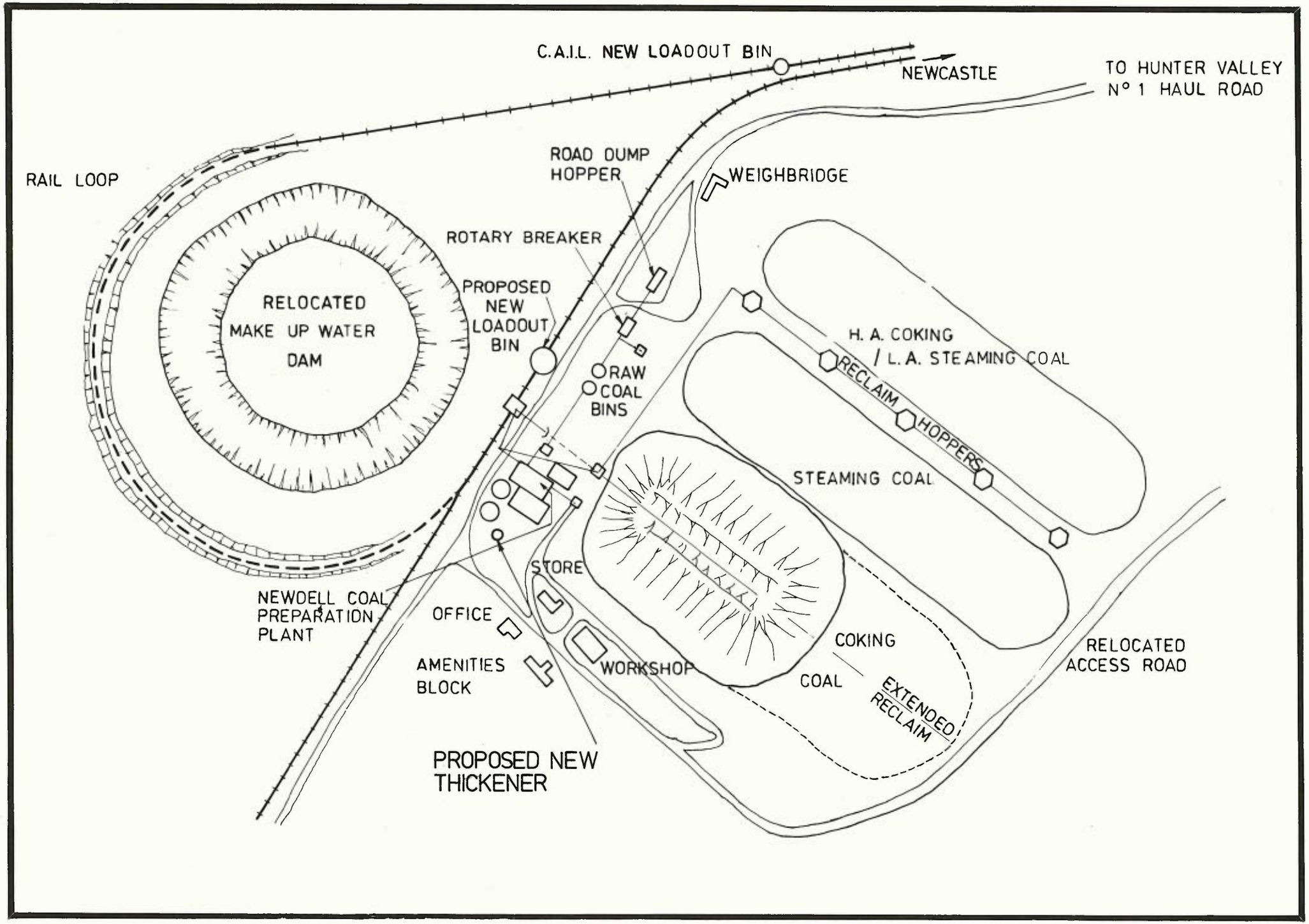

FIGURE 10 EXISTING NEWDELL COAL WASHERY AND LOCATION OF PROPOSED THICKENER

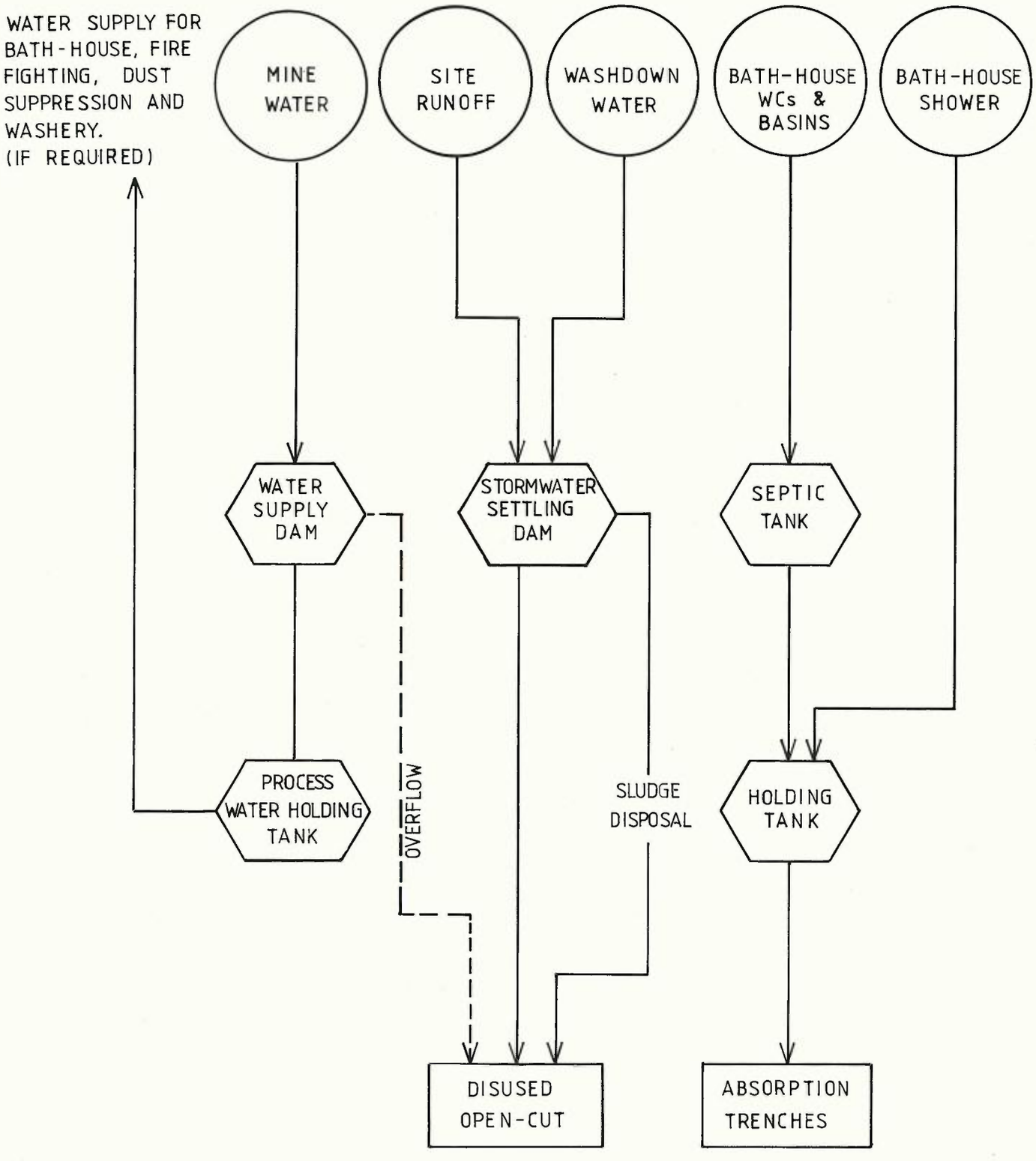

FIGURE 11 SCHEMATIC FLOWSHEET FOR WATER MANAGEMENT SYSTEM

north wall of the old cut forming the pit top area and into the adjacent old open cut on the north side of the new Pikes Gully mine. It will be allowed to percolate into the ground in the old open cut or in the unusual event of the cut filling up will overflow into Bowman's Creek (Foy Brook). Locations of these features are shown in Figure 12.

Underground mine water collecting in the supply dam on the south side of the access road will be retained in that dam until such time as the dam is full. This dam will also collect some surface water run-off. When the dam is full it will overflow by gravity into the old open cut area to the north, which also will collect stormwater from the pit top area.

Toilets from the bathhouse will be drained into a 4.5 cubic metre septic tank which will overflow into a 5.5 cubic metre inground holding tank adjacent. Bath water from the bathroom, offices etc, will flow directly to the 5.5 cubic metre holding tank and all water (both bathwater and overflow from the septic tank) will then be pumped up the north wall of the old cut area forming the pit top and into absorption trenches of total length of some 150 metres where it will be allowed to soak away into the soil.

The mine water supply will be provided from the dam on the south side of the access road which is shown in Figure 13. As mentioned previously this dam collects both underground mine pump out water plus some surface run-off. At present there are no quantitative figures on the exact quantities of mine pump out water, but as the volumes pumped out of the adjacent Foybrook underground mine would be adequate to supply both the Foybrook mine and the new Pikes Gully mine and the Foybrook mine is below the Pikes Gully mine it is considered certain that there will be adequate water available for both underground pits, especially as their water supply arrangements are interconnected.

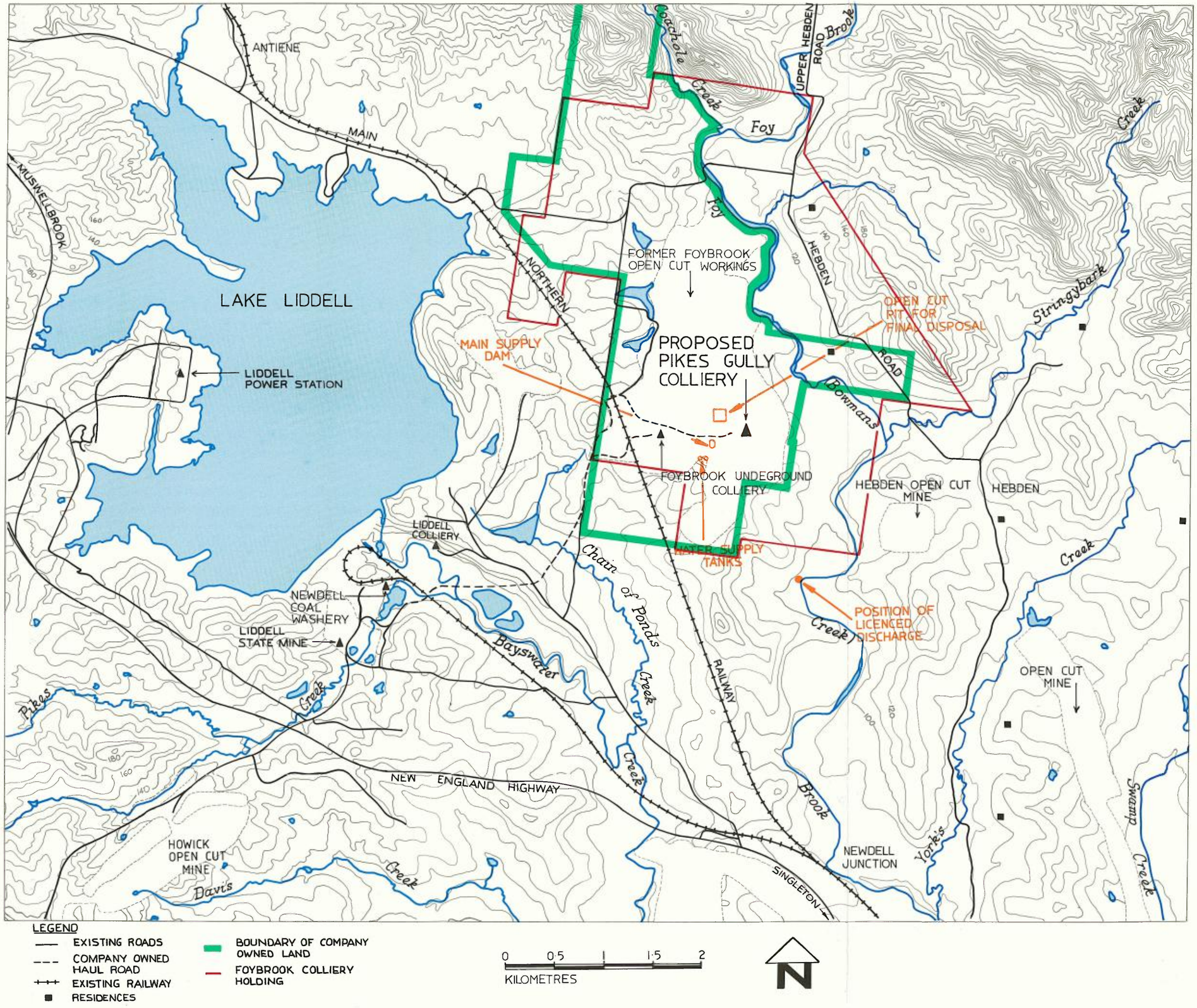

FIGURE 12 WATER MANAGEMENT FEATURES

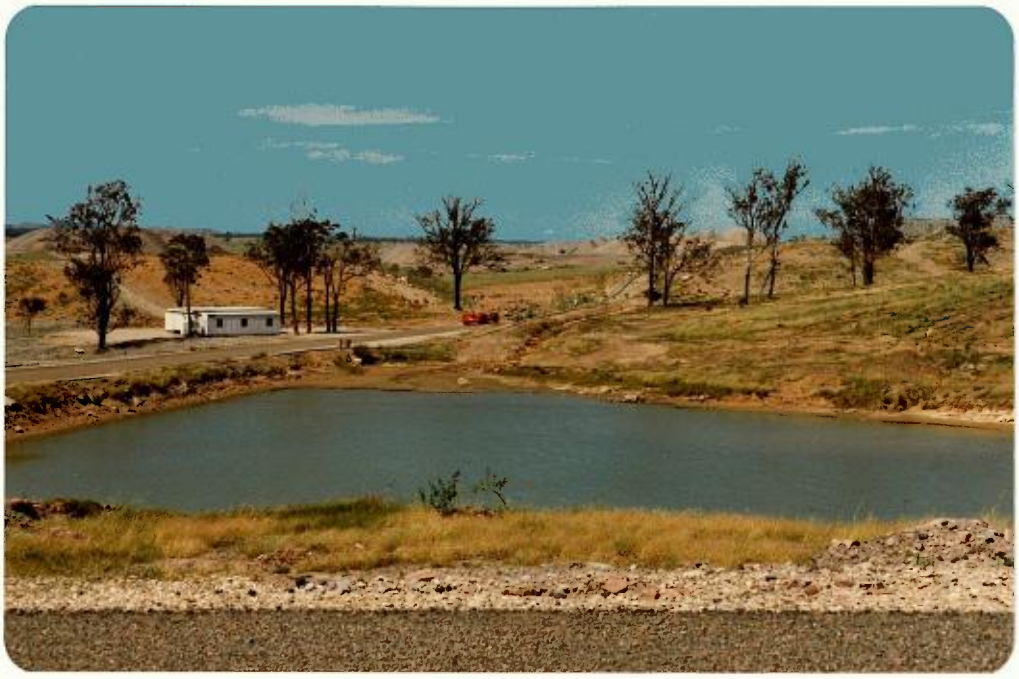

Figure 13. Land surface adjacent to proposed colliery. Showing supply dam and access road which leads down to the Pikes Gully pit-top area.

Nominally, the supply to the Pikes Gully mine will be drawn from the supply dam on the south side of the access road and will be pumped to the twin 230,000 litre tanks on the hilltop between the Pikes Gully and the Foybrook underground mines (which can be seen in the centre of Figure 2.). These two tanks also receive the supply of water pumped from the Foybrook underground mine and will supply both the Foybrook and Pikes Gully mines for bathwater, fire-fighting and dust suppression and when necessary they also supply Clutha's Newdell washery adjacent to the rail loop to the west.

It is considered likely that the underground mine water removed from the Pikes Gully mine will be essentially the same water that would otherwise be removed from the lower Foybrook underground workings. Any water discharged to Bowman's Creek (Foy Brook) under overflow conditions will be within the criteria set for the existing State Pollution Control Commission licensed discharge.

The quality of the underground mine water as set out in Table I shows that the mine water is suitable as pumped from underground for use for bathing, dust suppression and other uses around the pit top area. This water is already used in the basically untreated condition at the Foybrook underground mine and it is proposed to do the same at Pikes Gully. Consequently no specific programme for the water treatment for the underground water or for the water to be used around the pit top area will be required for Pikes Gully.

The stormwater collection dam on the north side of the headings to the underground mine will collect all run-off water from within the pit top area. Cut off drains are designed to minimise the flow of stormwater over the banks of the old open cut and into the pit top area. All rainfall falling within the pit top area will flow to the stormwater dam and there will be no separation of clean water or dirty

water within the pit top area, as all water needs to be pumped from the pit top area which is lower than the surrounding natural ground level.

There will be no alteration to the water management programme at the Newdell washery.

4.8 Washery Reject Disposal

Washery reject material from the Company's Newdell Coal Washery is currently removed by trucks and deposited in remaining large open-cut pits in the Foybrook area. This practice will continue as part of the land-filling and restoration process in this disturbed area. Reject from the washing of Pikes Gully Coal will also be disposed of in the same way.

4.9 Workforce and Hours of Operation

The estimated workforce at Pikes Gully Colliery is 108-110 men. The mine will be worked on a four shift basis for 220 days/year, with the maximum production shift manning 45 people.

The estimated increase in workforce at the mine (including construction personnel) is:

1982	9-77 men
1983	77-108 men

By 1983 the mine will be in full production and the workforce is expected to remain about constant.

Construction during 1982 will require no more than 20 men at any one time. Most are expected to be local persons and no construction camp is proposed. Transitional accommodation will be provided as outlined in Section 5.6.

The mine will be worked continuously between midnight on Sunday until Friday afternoon. This shift times are

Day Shift	7 a.m. - 2 p.m.
Afternoon Shift	2 p.m. - 9 p.m.
Swing Shift	9 p.m. - 4 a.m.
Dog Watch	Midnight - 7 a.m.

The mine will be continuously ventilated for 24 hours a day seven days a week. This means that the ventilation fan will operate continuously even over the weekends when the mine is not normally manned. As a consequence noise emmission from the mine will be almost steady as the principal source of noise generation is the mine fan. This is discussed more fully in Section 6.4

4.10 Closure of Mine

When the estimated ten year life of the mine is reached, and the Pikes Gully Seam has been worked out, the mine will be closed. Employees will be transferred to another similar mine in the district.

All equipment and building structures will be transferred to another new mine site. The pit top area will then be progressively filled in, most probably with washery reject, and then the whole area will be contoured in harmony with the surrounds using overburden and top soil before being seeded with grass.

5.0 ENVIRONMENTAL SAFEGUARDS

5.1 Air Quality

All roads and traffic areas will be sealed to prevent the generation of surface dust in the pit-top and access areas. External conveyors will be covered and shielded on one side to prevent the entrainment of coal dust by wind. The truck loading area will be cleaned and washed regularly to avoid spilt coal being picked up on truck tyres and carried out onto the access road with consequent dusting problems.

It is proposed to establish a number of deposit gauges in the area around Pikes Gully mine to monitor dust fallout in the vicinity. If necessary in the future further safeguards will be introduced as required.

5.2 Water Quality and Drainage

As described in Section 4.6 all water from Pikes Gully mine will be pumped to the supply dam adjacent to the access road and will overflow by gravity from the supply dam into the old open cuts to the north of the Pikes Gully mine.

These open cuts are very substantial and are presently almost free of water. Their volume is considered to be far greater than any likely inflow of water which could occur even under the most severe storm conditions from the Pikes Gully mine. However, in the event of this open cut becoming full of water it will overflow into Bowman's Creek (Foy Brook).

This overflow will be the only discharge of water from the Pikes Gully mine. The overflow point from the open cut will be monitored on a monthly basis to determine whether any overflow is occuring and if so the flow quantity and the quality of the discharge.

Surface run-off water from the pit top area will be collected as described in Section 4.6 and then also pumped to the old open cuts. Any sludge from the stormwater dam will also be disposed into old cuts.

Effluent from the bath-house will be collected in a 4.5 cubic metre septic tank and 5.5 cubic metre holding tank and then pumped up to a series of absorption trenches located outside the pit area, as shown in Figure 7 and described in Section 4.6.

The existing water management system at the Newdell washery will be retained and will not be altered as it is operating satisfactorily.

5.3 Noise

Activities at the proposed Pikes Gully mine pit-top area will generate substantial levels of noise in the immediate vicinity. The major sources of noise will be from the conveyors, the coal bin loading and truck loading, the ventilation fan and general traffic and workshop noise.

All mining will be carried out by continuous miners so no blasting will be required. Blasting already occurs in the adjacent Foybrook and Hebden Mining open cut mines.

The main safeguard against noise emmission from the proposed Pikes Gully mine will be that the whole of the pit top area is recessed below the surrounding ground level. The major sources of noise, the fan, the conveyors and any other mechanical equipment in the pit top area will thus be shielded from the surrounding areas and this is not expected to cause any problems of noise propagation as discussed more fully in Section 6.4.

The Pikes Gully site is remote from residential areas, the nearest houses being over 1 km to the east where high noise levels occur from the Hebden mining operation. Only the top few metres of the coal conveyor and storage bin will project above the surrounding landform and thus may allow some propagation of noise beyond the site area.

Plant equipment which is required to operate at the surface will be effectively designed and shielded to reduce noise to acceptable levels, as required under the Noise Control Act.

As soon as the mine is operational, noise levels will be monitored by conducting a further noise level survey to ensure that the activities conform with the approvals and conditions issued under the Noise Control Act.

Trucks carrying coal from the mine will use the Company's access road to the existing Newdell Coal Washery. This route is currently heavily used by coal trucks from Foybrook Underground and open cut mines, and does not pass any residential properties. All vehicles will be required to meet noise limits imposed on road vehicles by the Department of Motor Transport.

The minor modifications proposed at the Newdell washery are not expected to vary the noise emission, and no new attenuation procedures are proposed.

5.4 Mining Controls

Underground mining at Pikes Gully will utilise the bord and pillar method and where conditions allow, total extraction will be carried out to maximise the utilisation of coal resources. This will occur only below areas where surface subsidence effects will not cause major damage or loss of amenity to landowners' property. Any damage caused to

buildings, fences, dams or water supplies will be remedied by the Company.

Mine workings will be controlled and restricted according to requirements laid down by the Department of Mineral Resources in respect to mine safety and surface stability.

5.5 Restoration of Pit-Top Area

The land surface in the vicinity of the proposed pit-top has been greatly disturbed by previous open-cut mining activity. Most of this area is being progressively graded and rehabilitated. An example of a revegetated area of the Company's Howick open cut is shown in Figure 14.

The construction of the Pikes Gully Mine entry and surface installations will cause only minor alteration to the existing landform which has been deeply excavated and remains largely unrestored in the vicinity.

After approximately 10 years, when the mine is expected to close, the pit-top area will be available for revegetation as surface installations are removed (see Section 4.8).

5.6 Provision of Housing

Clutha Development Pty. Limited intends to make arrangements aimed at providing new recruits for their proposed Pikes Gully mine with a selection of suitable housing for purchase. In order to achieve this Clutha is entering into arrangements with Muswellbrook Shire Council, Singleton Shire Council and St. James's Parish Committee in Muswellbrook aimed at providing 75 building lots in the towns of Muswellbrook and Singleton.

Figure 14. Revegetation of former open-cut mined land in another of the Company's lease areas in the upper Hunter Valley.

TABLE VIII - SUMMARY OF PROGRESSIVE EMPLOYMENT, HOUSING REQUIREMENTS, LAND AVAILABILITY AND PROPOSED HOUSING PROVISION FOR PIKES GULLY COLLIERY WORKFORCE

Date	Employment (Recruitments)		Housing requirements		Anticipated Land Availability in Lots				Projected House Completions	
	Per Month	Progressive Total	Per Month (Projected)	Progressive Total	Singleton Council	Catholic Church	Muswellbrook Muswellbrook Council	Land Commission	Per Month	Progressive
1981										
August						10				
September										
October										
November										
December					2	10				
1982										
January										
February	9	9	6	6	2			8		
March	4	13	3	9	2			3	10	10
April	2	15	1	10	2			4		
May	7	22	5	15	2					
June	8	30	6	21			10		12	22
July	7	37	5	26	11					
August	8	45	6	32					10	32
September	9	54	5	37				4	5	37
October	8	62	6	43				5	6	43
November	7	69	5	48					2	45
December	8	77	6	54					10	55
1983										
January	9	86	6	60					11	66
February	8	94	5	65						
March	7	101	5	70					4	70
April	7	108	5	75					5	75
				TOTALS	21		54			

These blocks will be built on under contract between Clutha and a builder so that a selection of housing will be available progressively to recruits at Pikes Gully for purchase over the period of development of the mine. Table VIII shows the estimated progressive requirements for housing, estimated employment (full time) and anticipated availability of land lots over the development period for the mine between 1981 and 1983.

The houses to be developed will generally be in three price brackets as follows:

Category 1	29	Employees	$55-68,000
2	32	"	$68-85,000
3	14	"	$85,000 +

The houses to be developed will be built by a builder who will then be required to offer them for sale to recruits of Clutha Development. The sale price of the housing will be at the cost of development and holding charges plus reasonable profits, and is expected to be well under the market price for housing in the general Muswellbrook - Singleton area.

In addition, Clutha will use its best endeavours in an arrangement with a local building society to ensure that adequate finance is available to enable the new recruits to purchase the housing which is being offered to them.

In recognition that houses will not always be available or cannot always be purchased the moment that recruits move into the area, the Company propose to take two actions. Firstly, it is intended that the housing being developed by the company will be available on a rental only basis when the recruits first move into the area. The sitting tenants will then be able to complete the purchase and buy the housing

outright. In addition there will be occassions when the housing is not available immediately for purchase, so the Company propose to make transitional housing available so that accommodation can be provided to recruits migrating into the area. Villas and/or townhouses will be purchased by the company and let to the recruits at market rental for a restricted settling in period for this purpose. This should be sufficient for the other housing to be purchased or made available to the new recruits moving to the area.

It is anticipated that the purchase price for the land will include a contribution to the costs of infrastructure in the towns of Muswellbrook and Singleton which would provide for the supply of sewerage services, water and some social amenity in the town.

6.0 ENVIRONMENTAL INTERACTIONS AND ASSESSMENT OF ENVIRONMENTAL IMPACT

6.1 General

The proposed Colliery will be contained within an existing open cut excavation and integral highwall and so environmental impacts will be minimal. The facilities will be almost entirely shielded from the surrounding countryside by the immediate topography thereby minimising the effects of noise propagation and visual intrusion.

Possible sources of air pollution and water pollution will be controlled, as at the adjacent Foybrook Underground Colliery, to comply with the provisions and requirements of the Clean Air Act and Clean Waters Act.

The unnatural, disturbed and generally unattractive landscape in this area of former surface mining will not be affected by the development and, in fact, as restoration and re-vegetation by the Company continue, the area will be stabilised and greatly improved.

The Company's Newdell coal washery has an existing capacity of 3.2 million tonnes per annum of raw coal. The minor internal modifications to the washery in the fines section, which are being implemented to handle the existing throughput from the Foybrook and Howick open cut mines and the Foybrook underground mine, will enable the washery to handle the output from the Pikes Gully Mine also. It is not anticipated that there will be any increase in stockpile size or that the additional tonnage from Pikes Gully would cause air, noise or water pollution problems on its own account.

6.2 Newdell Washery

The expansion of the Newdell coal preparation plant (washery) is minor. The work is confined to increasing the capacity of the fines section only and includes building an 8 metre diameter Enviroclear thickener outside the present washery building as the sole outside works, which can be seen. The other changes necessary include increasing conveyor drive power, and alteration to pump capacities for water and slurry recycled within the washery. There will be no alterations to the washery building and the stockpiles will remain the same size as at present.

Air and water quality will not be affected by the increased coal throughput and noise levels at the washery will not increase.

The Newdell washery is being expanded principally to handle coal from the Company's existing operating mines. For this purpose capacity will be increased from 2.6 million tonnes per annum to 3.2 million tonnes per annum. At this capacity the Newdell washery will be adequate to accept the additional 440,000 tonnes per annum of coal from the Pikes Gully mine without any further modifications. All coal will continue to be transported away from the washery by rail to the port of Newcastle.

6.3 Air Quality

The air quality in the general area of the proposed mine site is at present affected by emissions from Liddell Power Station, open-cut coal mining operations and substantial transport activity.

The normal rural air quality status has therefore been significantly altered and it is not considered that the

proposed colliery will cause any adverse effect. The coal leaving the mine will be both wet and enclosed on the conveyor. It will be stored in a bin until loaded into trucks for transport to Newdell Washery.

Spillage around the bin will be cleaned up, as set out in Section 5.1 and all roads used for coal transport will be sealed.

It is considered that the Pikes Gully Colliery will not be a source of coal dust emission. In addition, the continuing re-vegetation work around the proposed mine site will in fact improve air quality by avoiding wind-induced dust generation from unvegetated areas of the mined out open cut areas.

6.4 Water Quality

All surface run-off, mine water and sewage effluent from the site is proposed to be contained within the mine area, on land owned by the Company, and disposed of into existing open cuts or used to augment the existing supply for the washery. This will ensure that contamination of natural water courses will be avoided.

All surface run-off, including rainfall, from the pit top area will be collected in the pit top dam and will undergo some settlement there before it is pumped to the adjacent old open cuts.

It is considered that the Pikes Gully Colliery will cause no water pollution whatsoever.

6.5 Noise

The major items of plant to be installed at the pit-head, and likely to generate substantial noise levels, will be

contained entirely within the former open-cut. This will have the effect of largely shielding the operations and preventing noise propagation beyond the immediate area.

These major noise sources include the ventilation fan, compressors, coal conveyor, storage bin loading, truck loading and general workshop and traffic noise. Measurements at the high edge of the large pit overlooking the Foybrook Underground Colliery indicated a drop in noise level of 10 dBA between the edge of the cut and at only 10m distance back from the edge. This serves to illustrate the shielding and noise reduction provided by siting the colliery in such a topographic depression.

The top few metres of the conveyor gantry and coal storage bin will be slightly higher than much of the surrounding landform and this will allow some noise to be transmitted beyond the site. From observations and measurements at the Foybrook Underground Colliery, it is estimated that the high conveyor loading coal into the storage bin would cause a noise level of up to approximately 60 dBA at 50 metres. Using the standard attenuation rate for free field conditions and, without allowing for ground absorption, this would suggest a maximum noise level at 1 km distance of around 35 dBA. It is therefore estimated that for a "worst case" situation, the coal bin loading could cause noise up to this level at the two nearest residences. Projected maximum noise levels which could arise from both Pikes Gully and Foybrook Collieries are shown by contours in Figure 5.

However, normal ambient noise at these locations (sample points 3 and 4 on Figure 5) is around 40 dBA and therefore it is unlikely that the Colliery noise will be heard and will certainly not cause any disturbance.

Noise from coal trucks using the access road is unlikely to cause disturbance at these residences and the already heavily used road route to the coal preparation plant passes only one residence, which is owned by the Company.

6.6 Landform and Stability

The preparation of the site area will include earthworks which will improve the stability of the exposed surfaces surrounding the pit area. Much of the area excavated by surface mining is still in an unrestored and unnatural state and grading and planting of these surfaces is continuing. The area will eventually be rehabilitated in a manner similar to that shown in Figure 14 which shows regrowth on another of the Company's open-cuts at Howick, which is about 8km away.

It is possible that some surface instability in the form of subsidence effects could occur above mine workings where total (pillar) extraction is carried out. However, this is not expected to seriously affect any natural or structural features in the area and, in any case, mining controls will be imposed by the Department of Mineral Resources where necessary. Any damage resulting to buildings, fences, farm dams or water supplies will be remedied by the Company.

The mining lease area does not extend as far as the foreshores of Lake Liddell so that any post mining subsidence cannot affect Lake Liddell.

The only significant surface feature which could be affected by subsidence is Bowmans Creek (Foy Brook), and any water which might enter the workings in this way would collect in the open cut and would subsequently be discharged back into the Bowmans Creek.

Figure 4 shows the extent of the Colliery Holding and also the fact that there are no surface features of any significance within this holding which might be affected by the proposed Pikes Gully mine.

6.7 Flora and Fauna

The site area has been substantially altered by surface mining and the lack of a natural surface and native vegetation has meant that the area has little or no value as habitat for native animals. It is therefore considered that the Colliery installation will have no effect on native fauna.

Vegetation in the area of the proposed colliery is very scanty and can only be improved by planting for stabilization and landscaping purposes around the site. The Foybrook open-cut area will be progressively rehabilitated by the Company. Evidence of what can be achieved is shown in Figure 14.

6.8 Visual Amenity

It is not considered that the Colliery will cause any loss of visual amenity in either the immediate site vicinity or when viewed from a distance such as along the Hebden Road.

The only feature which may be visible from beyond the immediate site surrounds will be the upper section of the conveyor gantry and coal storage bin. This feature will rise some 5 or 6 metres above the surrounding land surface and may therefore be visible as a minor distant feature from a distance of over 1 km along the Hebden Road.

However, the skyline produced by the former and present surface mining activities in this area is dominated by unattractive spoil heaps and dragline operations at both the Foybrook and Hebden open-cuts. In this context, the small visible section of the Pikes Gully installation will cause negligible aesthetic impact.

This entire landscape will be progressively re-contoured and rehabilitated as surface mining is completed and will eventually provide a much improved and more attractive visual feature.

6.9 Traffic Considerations

As indicated in Section 4.5, 22 tonne capacity coal trucks will be used to haul run-of-mine coal from the mine to the Newdell Washery, a distance of 5 km, over the existing Foybrook access road. This will require, on average, 80 truck loads of coal per day, suggesting a total of 160 truck movements over a 24 hour period.

The Company's own private road between Foybrook and Newdell currently carries a total daily average of about 300 truck movements. It is considered that the additional truck and light vehicle traffic generated on this and other roads in the vicinity by the proposed Colliery will not cause adverse safety or environmental impacts.

Private vehicle movements will occur predominantly at Shift-changes and will utilise the New England Highway and main Liddell Road. The numbers of these cars will not have any noticeable effect on traffic conditions.

6.10 Social and Planning Considerations

The material set out and the analysis outlined in Section 3.12 shows that some 60% of the workforce associated with the

development of the Liddell and Foybrook mines in 1952 located in Singleton, compared to some 80-85% of the regional mining workforce which in 1933 located in Muswellbrook. Further it is possible to infer that some 75% of the workforce associated with the Liddell Power Station have located in Muswellbrook.

Table IX shows the residential location for the present Clutha workforce in the Liddell area.

The residential location of the proposed 110 new employees at the Pikes Gully mine could equally well locate in Singleton or Muswellbrook depending on the availability of housing.

The availability of land suitable for zoning for residential development and general Government (Department of Environment and Planning) policy for regional development determines the location of available housing for the recruits to the Pikes Gully mine.

TABLE IX - DOMICILE OF PRESENT CLUTHA WORKFORCE FROM LIDDELL AREA

	% of total
Muswellbrook	32.6
Singleton	40.8
Cessnock area	7.3
Branxton	6.8
Scone	0.8
Denman	0.5
Other	12.5

These regional planning considerations are beyond the responsibility of Clutha Development and are being determined by the Department of Environment and Planning and Local Government.

As outlined in Section 5.6 Clutha Development have made arrangements to provide housing in both Singleton and Muswellbrook. This would indicate a split of approximately 30% locating in Singleton and 70% locating in Muswellbrook.

As both towns are of approximately the same size, it would be expected that infrastructure requirements would be equal for immigrants into the area locating in either centre. Similarly, it is expected that the break-up between basic and non-basic jobs in the two Local Government Areas would be similar and would increase from about 0.75 to 1.5 jobs per basic job over a 15 year period from the commencement of the Pikes Gully mine operations.

Research for a previous study (Ref. 3) indicated that some 40% of the Liddell Mine workforce commuted from outside the two Local Government Areas, but it is questionable whether under the current circumstances of job proliferation in mining in the upper Hunter region, that such a percentage of long-distance commuters would be sustained. It is therefore considered that only some 10% of the projected workforce will commute from outside. This suggests that the new Pikes Gully mine workforce will be distributed some 30% to Singleton Shire and some 70% to Muswellbrook Shire.

Other studies undertaken by Singleton Shire Council (Ref. 5) for the existing mine workforce in the region have shown that due to housing availability up to now some 65% of new recruits have located in Singleton Shire and some 35% have located in Muswellbrook Shire. However, this is not

applicable to the present project because Clutha Development have already made arrangements for housing for new recruits (see Section 5.6).

The Company's policy of arranging for the provision of serviced building lots and for the construction of a range of houses for new recruits will be a major factor in easing the housing shortage in Singleton and Muswellbrook for their recruits to the Pikes Gully mine. If this were not done the proposed mine development would compound the already severe housing shortage in these two centres. The scheme will provide more houses in Muswellbrook than in Singleton and thus will be contrary to the distribution of workforce which might be deduced from the Singleton Shire Council studies discussed above (Ref.5).

In addition, the provision of Company owned transitional accommodation and assistance in making finance available will ensure that the housing problems which might be associated with an influx of new recruits to the Pikes Gully mine will be minimised.

Table X is derived from the analysis in Section 3.12 and indicates ranges of likely numbers of basic and non-basic jobs in the two Local Government Areas and elsewhere. This table allows for growth in the non basic sector from 0.75 - 1.5 jobs per basic job over a 15 year period from the commencement of mine operations.

TABLE X - INFERRED BREAKDOWN OF
BASIC AND NON-BASIC WORKFORCE BY LOCATION AND TIME

		Start of Mine (1982)	Start + 5 years (1986)	Start + 10 years (1991)	Start + Start 15 (1996)
Muswellbrook	Basic	30	70	70	70
	Non-Basic	23	70	88	105
	Total	53	140	160	175
Singleton	Basic	10	28	30	30
	Non-Basic	8	28	35	45
	Total	18	56	65	75
Elsewhere	Basic	10	10	10	10
	Non-Basic	13	10	13	15
	Total	23	20	23	25

Table XI indicates the relationship between jobs and housing in the two Local Government Areas over the 1933-76 period.

TABLE XI - RATIO OF JOBS TO DWELLINGS

	1933	1947	1954	1961	1966	1971	1976
Muswellbrook							
Occupied dwellings	1566	1728	2262	2262	2787	3169	3264
Total jobs	3202	3089	3679	3463	4052	4861	4747
Jobs/dwelling	2.04	1.79	1.63	1.53	1.45	1.53	1.45
Singleton							
Occupied dwellings	2271	2226	2591	2591	3054	3063	3366
Total jobs	4567	3671	3996	3726	4616	4978	5735
Jobs/dwelling	2.01	1.65	1.54	1.44	1.51	1.63	1.70

The figures for Singleton include employment in defence and are, therefore, somewhat higher than could be expected in a normal situation. It is also to be noted that the increase in the number of jobs per dwelling in both cases in 1971 and in the case of Singleton in 1976 is associated with a marked increase in employment in the mining industry and construction and suggests a fair degree of boarding in the available housing stock. On the other hand the high incomes associated with mining activity are likely to lead to a high headship rate - a factor that is operating in the housing area generally, meaning that the number of jobs per dwelling is likely to decline further in line with the historical trend. In consideration of these factors, it is estimated that housing requirements will initially be at a lower level (1.55 jobs per dwelling) declining over the 15 year period from commencement when a more stable position is anticipated to about 1.40 jobs per dwelling. The projected housing demand is given in Table XII.

TABLE XII - HOUSING DEMAND

	Start (1982)	Start + 5 years	Start + 10 years	Start + 15 years
Muswellbrook				
Total new jobs	53	140	160	175
Jobs/dwellings	1.55	1.50	1.45	1.40
No. of dwellings	34	93	110	125
Clutha Provision	45	54	54	54
Singleton				
Total new jobs	18	28	65	75
Jobs/dwellings	1.55	1.50	1.45	1.40
No. of dwellings	12	19	45	54
Clutha Provision	10	21	21	21

The scale of employment implied by this project is relatively insignificant in relation to the two Local Government Areas. It is recognised that the cumulative effect of this and the many other projects under consideration in the Upper Hunter will involve dramatic changes to the two main settlements of Singleton and Muswellbrook and that consideration of these issues requires comprehensive investigation and the implementation of major development programmes to accommodate the growth that is already taking place in the region.

Investigation and planning for this is being undertaken by the Department of Environment and Planning and the two local Shire Councils (Ref: 6).

7.0 CONCLUSION

It is concluded that the proposal to establish a second underground mine entry and surface facility in the existing Foybrook Colliery Holding is consistent with land use and environmental constraints. The new Colliery will permit appropriate rational exploitation of available coal reserves within the lease area.

Due to the existing nature of the land surface and the remoteness of the mine site from residential and public areas, the direct physical environmental impacts will be minor. The proposal is entirely consistent with the present pattern of industrial and mining development in the Liddell-Ravensworth area.

Similarly the minor expansion to the Newdell washery is in keeping with the existing land uses at Liddell and will cause no reduction of environmental amenity.

It is considered that the overall environmental impact of the proposal for underground mining within much of the Foybrook lease area will be less than that which would result if the coal were to be mined by open-cut methods.

The sociological and economic consequences of the new Colliery, particularly the creation of an additonal 110 permanent jobs, are significant and are discussed in Section 6.10. The Company's proposed arrangements for the provision of serviced building blocks and for the construction of houses thereon for new recruits in Singleton and Muswellbrook are outlined in Section 5.6. It is considered that these actions, together with the purchase of townhouses for transitional accommodation by the Company, will assist in overcoming the planning and social problems which would otherwise occur in this already rapidly-growing area of New South Wales.

8.0 ACKNOWLEDGEMENTS

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