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BUREAU OF MINERAL RESOURCES
GEOLOGY AND GEOPHYSICS.

REPORT No. 1948/32.



COMMONWEALTH ASSISTANCE TO GOLD MINING.

Big Bell Mines, Ltd.

by

C.J. Sullivan,
Superintending Geologist.

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in Plan Cabinet Room.

Plans have been omitted from
the hardcopy of record 1948/32.

COMMONWEALTH ASSISTANCE TO GOLD MINING.

Big Bell Mines. Ltd.

by G.J. Sullivan.

Report No. 1948/32

In the present report it is sought to explain a number of points which were not brought out in the report by J.A. Dunn, of 2.3.48, and, in particular, to give an explanation as to why the Company now estimates that its annual loss would be £169,000 per annum as against an estimate of £100,000 per annum, given in the statement issued by the Chamber of Mines. Information is also given in this report concerning the present ore reserve position which is closely bound up with the proposed development programme.

ORE RESERVES.

The ore reserves in long dry tons at January 1st, 1948, were as follows -

	<u>Long tons.</u>	<u>Grade.</u> (dwt.)
Developed Ore.	1,001,000	2.94
Probable Ore.	1,065,400	3.82
Prospective Ore.	348,900	3.17
	<hr/>	<hr/>
	2,415,300	3.01
	<hr/>	<hr/>

On this mine, "developed ore" is ore proved by level development, winzing and diamond drilling which will be available for extraction when stope preparation has been completed. In the method of mining used at Big Bell, the "developed ore" has not necessarily been fully prepared for stoping, and this is a most important point. For example, at 1.4.48, although developed ore amounted to approximately 1,000,000 tons, Table A, at the end of this report, indicates that 562,217 tons of this ore were prepared for stoping, except for 2,121 feet of development which required to be completed. At the rate of production of 30,000 tons of ore per month from stoping this amounts to 1.55 years' life.

The term "probable ore" signifies ore which has been developed, and of which the grade is known, but which is only probably available for extraction at some future date. Stope preparation may not have been completed. This ore is mainly in pillars, but also includes partly developed ore, in which the values are not fully known.

"Prospective ore" is an arbitrary extension of the ore to a depth of 50 feet below the known occurrence. It has not been developed, and is merely a guide to the prospective value of the mine. Plate I accompanying this report shows the distribution of these various types of ore reserves. Plate II shows the development and stope preparation necessary to enable the ore at Big Bell to be extracted. The proposed development is shown in Table B at the end of this report.

FUTURE GRADE.

The probable grade of the ore to be mined at Big Bell requires very careful consideration because on a production of 400,000 tons per annum, each 0.1 dwt. affects income to the extent of £40,000 per annum.

It will be noted that the grade of the developed ore is given as 2.94 dwt., and the average for all ore reserves is given as 3.01 dwt. Against this, the statement prepared by the Company shows an anticipated grade of 2.83 dwt. This is the actual grade of ore mined for the four months, January to April, 1948. The figure 3.01 may be unduly high, one reason being that this is partly based on the drill hole near the shaft at the thousand-foot level (Plate I), which, as indicated on Plate III, would included the thickest and richest part of the orebody. The lower grade and narrower northern and southern extensions of the lode will also require to be mined.

For the year 1947, on a throughput of 357,623 tons, the average head value was 2.77 dwt. It is very difficult to estimate exactly what the head value for 1948 will be. In the traverse stopes for example, stoping moves across from the hangingwall to the footwall, and, as shown on Plate V, these stopes cross alternating bands of ore of varying grades. For the year 1948, the monthly grades have been as follows:

January	2.80
February	2.71
March	2.93
April	2.91
May	3.06

These figures show a marked increase in recent months, and the difference in grade between January and May would affect income to the extent of almost £80,000 per annum. The increase in May is partly due to pillar extraction in the oxidised zone, which, owing to secondary enrichment, is of a higher grade than the primary ore. A very limited quantity only of this ore is available. However, it is not unlikely that the grade of ore for 1948 may be 2.9 dwt. as against the estimate of 2.83. If this were so, the Company would receive revenue of £12,000 for the year, in excess of the estimated income. Without knowing precisely what the grade will be, it is most difficult to estimate what the actual subsidy should be. It is suggested that any subsidy should be related to grade, but that an attempt should be made to ensure that mining methods do not involve the extraction and treatment of undue quantities of low-grade material. This provision is, of course, not at all easy to enforce. It is considered, however, that the Management and technical staff are of high calibre, and that adequate efforts would normally be made in this direction.

SELECTIVE MINING.

The remarks by Dr. J.A. Dunn (page 19) on this matter are fully endorsed. The distribution of ore at No. 4 level is shown on Plate V. This indicates that there are higher grade sections in the orebody, but that they would be most difficult to mine, except by a drastic change in methods which would increase mining costs in a very marked manner. It is doubtful if the Company itself would consider a change involving the selective mining of these higher grade portions, as the Company considers that the saving involved would be more than offset by increased costs.

DEVELOPMENT.

The major factor which has raised the estimated cost of subsidy as at present prepared by the Company, above that submitted through the Chamber of Mines to Dr. Dunn, is the provision in the Company's last estimate for development

at the rate of 1,150 feet per month, which, at a cost of 198.2 shillings per foot, amounts to £11,396 per month, or approximately £137,000 per annum. The figure of 198.2 shillings per foot appears rather high when compared to a cost of £6 to £7 per foot on a number of the Kalgoorlie Mines. A partial explanation may be found on Table B which shows that drifts and cross cuts range from 11' x 8' to 7' x 7'. These are large openings, and, naturally, are expensive. A second factor covering the high cost, is the type of ground which does not "shoot" well, and involves a high expenditure on drilling and explosives as compared with the more brittle greenstones at Kalgoorlie, for example. On the Enterprise Mine at Kalgoorlie, a 9 by 9½ foot drive at the 2,200 foot level is costing between £9 and £10 per foot.

10222
A very important factor bearing on development, is the interval at which pillars are left in the mine to prevent collapse after ore has been extracted. Above No. 4 level, the stopes were 65 feet in length, and pillars were 35 feet in length. This interval was found to be satisfactory for the support of the mine. However, between the Nos. 6 and 4 levels, the stopes were increased to a length of 107 feet, and width of the pillars ~~were~~ 23 feet. This was done to increase the percentage extraction of the orebody and to reduce development costs. The increased pillar interval gives 45 tons of ore per foot of development or stope preparation as against 32.7 tons per foot above No. 4 level. It has now been found, however, that the pillars between the 6 and 4 levels are failing owing to the weight of the hangingwall and it has been decided that between the 8 and 6 levels, it will be necessary to return to the old pillar interval. This greatly increases the development necessary to maintain ore reserves.

It was estimated by the Management (and confirmed by independent investigation) that 950 feet of development per month would be required to maintain the present ore reserve position. As pointed out, however, under the section on ore reserves, the ore actually prepared to stoping, amounts to 1.55 years' supply. This should be compared with the position of mines such as the Enterprise at Kalgoorlie, where proved ore reserves amount to 253,250 tons, which are virtually available for stoping and represent 4 to 5 years' supply at the present rate of mining of 50,000 tons, per year. Similarly, on the Boulder Perseverance Mine, proved ore reserves (available for stoping) amount to approximately 358,000 tons, or three years' supply of ore at the present rate of production. It is important to realise that the probable and prospective ore, and also some of the developed ore at Big Bell requires much development and stope preparation before it can be mined. The production of 30,000 tons of ore from stoping at Big Bell implies that at least two levels must be in operation at one time; it is possible to extract only about 20,000 tons of ore per month from one level, even though large quantities of ore may be available for stoping above that level. With the prospective exhaustion of ore above No. 4 level, it is necessary that No. 8 level be developed so as to provide sufficient faces from which ore can be won to maintain the economic level of production at around 30,000 tons per month.

The proposal to increase development by 200 feet per month over the estimated figure of 950 feet per month, which it is considered is necessary to maintain the present ore position is based on the conception that the mine requires two years ore prepared for stoping in order to be on a safe basis. The additional 200 feet per month would provide two years' ore supply within a period of two years as well as providing for current production.

As a guide to development requirements at Big Bell, the Wiluna Mines, when producing 50,000 tons of ore per month carried out approximately 3,000 ft. of development per month. Great Boulder, which produces 30,000 tons per month averages approximately 1,500 ft. of development per month.

By May of this year, the rate of development had attained 720 feet per month, but it would not be at all easy for the Company to increase development to a rate of 1,150 feet per month. The necessary equipment, power, etc. appears to be available, but the number of miners is a limiting factor. The Company states that it would be necessary to obtain an additional 30 to 50 men, and that these men would be available. However, it is considered that any increase in development, if agreed to by the Commonwealth, would be quite gradual, and the Company has been asked to prepare schedules showing the estimated development in the coming months, and the estimated cost of this work. Since each 100 feet of development per month means an outlay of approximately £12,000 per year, the amount of any subsidy required would be greatly modified by the amount of development carried out. It is considered that the development programme outlined by the Company is necessary if it is decided that the mine should continue operations indefinitely, but that it is not possible to estimate now exactly how much development could be carried out, and hence that the amount of subsidy must depend to a considerable extent on the development actually performed.

The present position regarding ore prepared for stoping is not satisfactory, and has partly resulted from continued ore extraction during the war without compensating development.

STOPES FILLING.

The failure of the pillars between the No. 6 and No. 4 levels and also of the supports above the No. 4 level, has had an important bearing on mining problems, apart from development. As stated in the attached letter from the District Inspector of Mines, Mr. C. Adams (Appendix I), the main shaft is only about 150 feet from the footwall edge of the glory holes in the old open cut. Mr. Adams states "Some large falls on the hangingwall have already taken place and though falls on the footwall have been of a minor nature, a very considerable crack has developed some twenty feet back from the edge of the glory holes towards the shaft, and extending for a length (parallel to the open cut) of perhaps 300 feet. Thus, a fall of possibly up to 50,000 tons of footwall rock could take place and possibly subsequently endanger the main shaft."

It is now found that with the increased pillar interval between the 6 and 4 levels, the pillars are beginning to fail and unless adequate support for the workings is provided, the whole mine will be in danger of collapse. Mr. Adams states further:-

"The whole position has been accentuated by conditions induced by the war and which were outside of any one's control. I was informed by Mr. Dale Pitt who was General Manager when war broke out, that the original glory hole pillars were designed to be a certain size, which was based on practice that had been found satisfactory in the glory holes at Mt. Isa. In the early stages, before 7th December, 1941, the war was a cash and carry affair and gold production was particularly important. The number of men working at Big Bell decreased steadily, owing to enlistments, yet production was kept up. This could only be done by stoping already developed ore reserves, at the same time, de-

creasing the amount of development. One means of keeping up production was to continue to mine ore from the pillars and thus make them smaller than originally intended. This matter was discussed between Mr. Pitt and myself and was consented to under close supervision because glory hole mining at Big Bell had produced by far the highest tonnage per man shift that had been attained in West Australia. It must be recognised that this policy was partly responsible for the falls that can now be seen in the glory holes, and which contribute to present ventilation difficulties. It was clearly understood at the time that some ore would inevitably have to be sacrificed at a later date. If the pillars had been left as originally intended, they could possibly have been successfully mined by internal development, and the ore largely pulled out before caving became dangerous. As they now stand, nearly all showing signs of failure, and surrounded by fallen wall rock, they are quite unpayable to mine, because of the excessive dilution which would be encountered in drawing the ore through the grizzlies."

/not

The question of supporting the walls between the 6 and 4 levels is still under consideration by the Management but it is likely that in the very near future it will be necessary to hydraulically fill all stopes from the No. 6 to the No. 4 level. Until adequate tests are made, the exact cost of this work is unknown, but a somewhat similar operation in the Great Boulder Mine costs in the vicinity of 2/- per ton. At Big Bell, it should cost more than this, owing to the large tonnages which will be handled, and may be a little lower. It is estimated that it will be necessary to emplace some 500,000 tons of fill which, at 2/- per ton, would cost £50,000. As against this, it is possible that approximately 100,000 tons of pillar ore between these levels may be obtained without further development, which would represent a development saving of approximately £25,000 at 4/- per ton. Hence, although the actual cost of stope filling is not clear, it may be of the order of £25,000 on 500,000 tons of ore, or approximately 1/- per ton. It is estimated that stope filling may cost between £15,000 and £20,000 in the next twelve months.

VENTILATION.

Appendix 1 of this report, which is a copy of a letter from the District Inspector of Mines at Cue, sets out the present position regarding ventilation at Big Bell. The Mines Department of Western Australia is responsible for the mining law of that State, and, in particular, for the enforcement of the ventilation regulations which are most important for the protection of the health of miners. The question of adequate ventilation is closely watched by mining unions. Briefly, the position is that, although it was quite easy to ventilate the mine while open stopes existed in the upper levels, with the progressive deepening of the workings and the falling of the hangingwall on the upper levels, an adequate system of ventilation is now required.

The original scheme prepared by the Underground Department involved the expenditure of approximately £40,000. At our request, every effort was made to revise this system and it is now hoped that a ventilation shaft, through which the vitiated air from the mine can be exhausted, can be sunk to the 613 foot level for a cost of approximately £20,000. It is considered by myself and by the Mines Department of Western Australia, that it would be most necessary to sink this shaft within a period of 18 months. The estimated cost of £1,100 per month given by the Company is considered to be reasonable.

POSSIBLE SAVINGS.

A research metallurgist has been carrying out tests on treatment which suggests that an additional 0.1 dwt. recovery may be obtainable with only a moderate variation in the circuit of the present plant. This would mean an additional income of approximately £22,000 per annum. Certain equipment which may cost up to £10,000 would be required to put this scheme into operation.

Consideration has been given by the Company to a scheme to increase tonnage from 34,000 to 45,000 per month. It is estimated that this would involve an expenditure of approximately £50,000 and there is a considerable doubt as to whether the proposed increase in tonnage would be a sound move. The increased throughput would certainly reduce the overall cost per ton, but there are considerable difficulties in the way of implementing the scheme, including the very severe difficulty of obtaining sufficient labour. It is considered unlikely that the Company would be able to implement this scheme at the present time.

Considerable experimentation has been carried out by the underground staff on the method of breaking the ore by blast-hole drilling. Very encouraging results have been obtained and it is considered quite likely that these experiments may lead to the saving of approximately 1/- per ton on 30,000 tons of ore broken per month, which is equivalent to approximately £18,000 per year. The combined saving from improved treatment methods and from improved blast-hole drilling methods would amount to approximately £40,000 per year.

SUMMARY.

Apart from the increased costs of supplies, labour, etc. sustained by all gold mines, the Big Bell mine will have increased costs for the following reasons:-

1. The crushing of the pillars above No. 6 level means that pillars will have to be left at closer intervals above No. 8 level. The effect of this is to increase very markedly the development and stope preparation necessary to provide for the mining of a given tonnage of ore: with the increased pillar interval, 1 foot of development or stope preparation provides 32.7 tons of ore, whereas previously it provided 45 tons of ore.
2. The crushing of the pillars has led to the necessity for hydraulic stowage or some such method of preventing collapse of the mine openings.
3. Owing to the fact that the mine is now getting well away from the surface, a proper ventilation system is required.

It is apparent that the subsidy which would be required by the mine to enable it to carry on, is very closely related to the grade of the ore which will be obtained, and also especially to the amount of development which can be carried out. It is considered practically impossible to estimate either of these factors with absolute accuracy at the present time, as, for one thing, the amount of labour which will be obtained in the near future is not predictable. In addition, there are possible savings by improved practice whose exact effect on the income of the mine is quite unknown at the present time. In these circumstances, it is considered almost impossible to estimate in advance the requirements of

the mine for 1948. The figure of £209,572 given by the Company (page 12) is an estimate based on a full years work at the maximum rate of development 1,150 feet per month. The implementation of the full programme would be quite difficult under present labour conditions, and certainly would not be attained for quite a considerable time. There is no doubt, therefore, that the requirements for 1948 will be very considerably reduced below the estimate given by the Company. It is considered that to a very large extent, any subsidy will have to be closely related to the actual amount of development carried out, to the grade of ore, to the cost of stope filling, to the progress of the implementation of the ventilation scheme and to the savings which are attained by improved practice.

Although a firm estimate of the actual amount of development which can be carried out, and of the cost of the various factors mentioned above, cannot be made at the present time, the following tabulation may serve as an indication of what, it is thought, these costs could be -

Revised Estimate of Mining Costs, June 30th
to December, 30th, 1948.

(See page 9 of Report by Company).

	<u>Per Month</u>	<u>Cost per ton.</u>
<u>Development Drilling:</u>		
280' @ 16.083/- per foot	£225	
<u>Main Shaft:</u>		
12.0' @ £111.6.8 per foot	£1,336	
<u>Development and Stope Preparation:</u>		
850' @ 198.2/- per foot	£8,423	
<u>Ore Breaking:</u>		
Blast-hole Drilling 20,000' @ 5/8.38 per foot	£5,698	
<u>Stoping:</u>		
30,000 tons @ 4.839/- per ton	£7,258	
<u>Haulage:</u>		
34,000 tons @ 2.11/- per ton	£3,587	
<u>Hoisting:</u>		
34,000 tons @ 0.939/- per ton	£1,596	
<u>Mine Drainage:</u>	£334	
<u>Ventilation:</u>	£1,000	
<u>Stope Filling:</u>	£700	
	<u>£30,157</u>	<u>17.74/-</u>

Taking these figures into account, a revised estimate (page 10) of the Company's report) showing the total costs for the 6 months, June 30th to December 30th, would read as follows:-

Mining Cost	£180,942
Milling Cost	68,556
Other Costs	30,108
New York Office Cost	1,560
Marginal Wage Increase	3,852
Fuel Oil Increase	3,666
Depreciation	16,116

£304,800

Estimated revenue for 6 months at
34,000 tons per month, head
value 2.83 dwt.

£245,454

Deficit

£ 59,346

It is considered quite possible that grade for the next six months may be a little above 2.83 dwt., and it is not unlikely that this would increase revenue by approximately £20,000. This figure also allows for possible savings in operating costs. On this basis, the cost of subsidising the mine, after allowing for depreciation, but not allowing for any profit for the six months June 30th to December 30th, 1948, could be of the order of £40,000.

24th June, 1948.
CANBERRA. A.C.T.

C. J. Sullivan
(C.J. Sullivan)
Superintending Geologist.

TABLE A.

ESTIMATE OF ORE AVAILABLE FOR EXTRACTION
IN STOPING BLOCKS AS AT 1ST APRIL, 1948.

LEVEL	BLOCK	DEVELOPMENT		TONS AVAILABLE (Not Broken)	BROKEN ORE IN STOPES	TOTAL ORE AVAILABLE
		FEET	TONS			
253	22	-	-	3850	3000	6850
433	7½	-	-	9165	20000	29165
	9	-	-	-	3250	3250
	9½	-	-	17614	-	17614
						Pillar ore
	10½	-	-	16654	-	16654 "
	15	-	-	15000	-	15000 "
	17	-	-	15000	-	15000 "
	18	-	-	8890	5877	14767 "
TOTAL		-	-	82323	29127	111450
613	7	758	3304	27335	-	30639
	8	319	1820	39730	-	41550
	9	100	450	40570	-	41020
	10	-	-	48985	500	49485
	12	-	-	34689	8750	43439
	13	-	-	50795	1000	51795
	14	-	-	60682	1500	62182
	16	-	-	64039	300	64339
	17	872	4067	55401	-	59468
TOTAL:		2121	9641	422226	12050	443917
MINE TOTAL		2121	9641	508399	44177	562217

TABLE B.SUMMARY OF PROPOSED DEVELOPMENT FOOTAGES
IN LEVELS.

<u>613' Level</u> - Drifts	(11 x 8)	664 feet	
"	(7 x 7)	12 "	
Xcuts	(8 x 8)	305 "	
	(7 x 7)	63 "	
Service Winzes	(7 x 5)	<u>935</u> "	
Total:		<u>1979</u> feet	<u>1979</u>

678' Sublevel -

Drifts	(11 x 8)	680 feet
"	(8 x 8)	28 "
"	(8 x 6)	940 "
Xcuts	(8 x 8)	1173 "
Raises	(7 x 7)	<u>600</u> "

Total:	<u>3421</u> feet	<u>3421</u>
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730' Sublevel -

Drifts	(7 x 7)	332 feet
"	(7 x 5)	226 "
Xcuts	(7 x 7)	1330 "
Raises	(7 x 7)	<u>470</u> "

Total:	<u>2358</u> feet	<u>2358</u>
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770' Sublevel -

Drifts	(10 x 8)	391 feet
"	(7 x 7)	135 "
"	(7 x 5)	21 "
Xcuts	(9 x 7)	981 "
"	(8 x 8)	22 "
Raises	(10 x 8)	<u>1224</u> "

Total:	<u>2774</u> feet	<u>2774</u>
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800' Level -

Drifts	(9 x 9½)	1000 feet
"	(7 x 7)	21 "
"	(8 x 8)	35 "
Xcuts	(9 x 9½)	295 "
"	(8 x 8)	160 "
"	(7 x 7)	173 "
Raises	(17 x 7)	575 "
"	(7 x 8)	<u>23</u> "

Total:	<u>2332</u> feet	<u>2332</u>
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TOTAL:	<u>12864</u>
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TABLE C.**SUMMARY OF DEVELOPMENT & STOPING.**

	Total Available Ore - Tons	Development in Stopes - Tons	Stoping tons Available	Devel- opment Footage	Factor Tons/Foot
8½	34008	3519	30489	1058	28.8
9½	43203	5156	38047	1326	28.7
10½	53203	5715	47488	1667	28.5
11½	55703	5692	50011	1475	33.9
12½	60703	5857	54846	1649	33.2
13½	62578	5970	56608	1323	42.8
14½	62578	5848	56730	1697	33.4
15½	53828	5832	47996	1261	38.0
16½	46328	5709	40619	1423	28.5
17½	36289	4830	31459	1006	31.3
	508421	54128	454293	13885	32.7

TABLE D.

SUMMARY OF FOOTAGES IN STOPING BLOCKS AND
PILLARS.

613' - 800' LEVEL.

	Proposed Development	Completed Development	Total Development
8½ Block	978	80	1058
9½ "	1044	282	1326
10½ "	1457	210	1667
11½ "	1166	309	1475
12½ "	1535	114	1649
13½ "	1221	102	1323
14½ "	1462	235	1697
15½ "	1187	74	1261
16½ "	1411	12	1423
17½ "	993	13	1006
800' level	410	-	-
TOTALS:	12864	1431	13885

GOVERNMENT OF WESTERN AUSTRALIA.

Office of the State Mining Engineer
Mines Department,
Central Government Buildings,
PERTH. W.A.

16th June, 1948.

Mr. C.J. Sullivan,
Bureau of Mineral Resources,
CANBERRA. A.C.T.

Dear Sir,

As promised in an interview of yesterday afternoon, I now offer some written comments on ventilation at Big Bell.

The orebody is mined over a length of some 1,000 feet and a width of 80 feet, with the Main Shaft in the footwall approximately at the centre. Ventilation practice to date has been to station a fan at the junction of the main crosscut and drive on each level, forcing the air through openings at either extremity of the orebody, with the Main Shaft downcasting. The openings referred to are usually not specifically designed as airways. Above the 250 level for instance, the air passes through the grizzlies and grizzley rises to the glory holes. When these grizzlies were being worked, one would be left open, while ore was being mined above and pulled out of the adjoining one, which when pulled right out became the airway, while ore was mined in the first one. The difficulty with this system is that worked out ground which is not filled, eventually caves, closing the air passages, which cannot be maintained. An obvious remedy is to construct an airway in unmined ground in which there is no possibility of caving and requiring a minimum of maintenance.

Up till now, no filling has been used in the old stopes, but the management is well aware that some means of preventing caving must eventually be adopted. The main reason for this is that though the Main Shaft is in the footwall, it is only about 150 feet from the footwall edge of the glory holes. Some large falls on the hangingwall have already taken place and though falls on the footwall have been of a minor nature, a very considerable crack has developed some twenty feet back from the edge of the glory holes towards the shaft, and extending for a length of perhaps 300 feet. Thus a fall of possibly up to 50,000 tons of footwall rock could take place and possibly subsequently endanger the main shaft. As a counter two schemes have been suggested. The mine could either be filled with mill tails or a large pillar extending the full length of the orebody could be left at the horizon of the 430 level. These propositions have been discussed to my knowledge more than twelve months, but as far as I am aware, no finality has been reached, which is to be expected in view of a number of recent changes in the management.

The immediate objective of these discussions between the various members of the mine staff would appear to be the protection of the Main Shaft and the prevention of the development of too much pressure on the lower levels, which would necessitate expensive timbering and increased costs. They do, however, have a direct bearing on ventilation pro-

blems.

If the mine is filled with tails, the ventilation is likely to be an easier proposition than if it were left open and supported by pillars. One of the major considerations in ventilation of large open stope mines is to prevent air from being dissipated or short circuited in open stopes. Constant attention is required in a large mine like Big Bell, because the size and number of openings are continually varying. If such a mine is filled, it is relatively simple to confine air to passes within the fill which can be kept in order.

The whole position has been accentuated by conditions induced by the war and which were outside of any one's control. I was informed by Mr. Dale Pitt who was General Manager when war broke out that the original glory hole pillars were designed to be a certain size, which was based on practice that had been found satisfactory in the glory holes at Mt. Isa. In the early stages, before 7th December, 1941, the war was a cash and carry affair and gold production was particularly important. The number of men working at Big Bell decreased steadily, owing to enlistments, yet production was kept up. This could only be done by stoping already developed ore reserves, at the same time, decreasing the amount of development. One means of keeping up production was to continue to mine ore from the pillars and thus make them smaller than originally intended. This matter was discussed between Mr. Pitt and myself and was consented to under close supervision because glory hole mining at Big Bell had produced by far the highest tonnage per man shift that had been attained in West Australia. It must be recognised that this policy was partly responsible for the falls that can now be seen in the glory holes, and which contribute to present ventilation difficulties. It was clearly understood at the time that some ore would inevitably have to be sacrificed at a later date. If the pillars had been left as originally intended, they could possibly have been successfully mined by internal development and the ore largely pulled out before caving became dangerous. As they now stand, nearly all showing signs of failure, and surrounded by fallen wall rock, they are quite unpayable to mine, because of the excessive dilution which would be encountered in drawing the ore through the grizzlies.

Just as falls have taken place in the glory holes, so can they be expected with open stope methods at greater depth since rock pressures will be increasing.

Another common difficulty of ventilation of large mines in arid climates that has to be faced at Big Bell is caused by natural conditions. In the heat of a summer's day the Main Shaft tends to upcast instead of downcast, even in mines which are adequately equipped, with the result that smoke and dust hang in large areas of the underground workings and under these conditions miners are subjected to increased dust risk.

I am convinced that the Big Bell Mine has reached that depth at which mining costs must show a sharp rise, which, coupled with the usual difficulties of the day that will be well known to you, puts them more or less in a position of acute crisis. There is no doubt that to comply with the Mines Regulation Act, a much more positive ventilation scheme will have to be adopted if mining at depth is to be persevered with.

It is hoped that this somewhat general treatment of the subject may present aspects that may not have been made apparent in the time at your disposal.

Yours faithfully,
(Sgd.) C. Adams.
DISTRICT INSPECTOR OF MINES, CUE.

APPENDIX II.

Report submitted by Company showing monetary requirements of the Big Bell Gold Mines Ltd. (One copy with original of this report and one copy in possession of Mr. N. Drummond, Treasury Department).

APPENDIX III.

SUPPLEMENTARY NOTE FOLLOWING DISCUSSIONS WITH COMPANY REPRESENTATIVES.

Big Bell Mines Ltd.

The following points have arisen from discussion with Mr. Evan Holder, Assistant General Manager, Big Bell Mines, Ltd, who, together with Mr. J. Sweet, Chief Accountant for the Company, was in Canberra 29th-30th June.

1. The management and directorate of the Company, which are composed of very competent mining engineers appear to be convinced that the Big Bell is potentially a valuable mine, capable of long-term, profitable operation. The company appears to be willing to back this opinion at least to the extent of foregoing any immediate profit which might be obtainable by salvaging the mine and realizing on the plant.

The directors are apparently convinced that very considerable improvements in mining techniques are possible - even probable - and this is considered to be the main means whereby the mine can be put on a profitable basis.

2. The company does not visualize the continuance of the mine on the basis of a permanent subsidy but considers that the assistance requested would enable them to catch up on development and would give them the time necessary to realize on improved practices, at present in an experimental stage.

Mr. Holder considers that the Company would need assistance, approximately on the scale suggested, for a period of approximately two years. At the end of that time, he considers, the amount of assistance required should be very materially reduced, or, alternatively, no assistance might be required at all.

In compiling the estimates, the Company has not allowed for any improvements in the tonnage to be obtained per foot of development nor for any improvements in general mining methods. Between the 613' and 800' levels, the Company is not yet entirely committed to any given development layout and it appears not at all improbable that a scheme will be adopted which will yield considerably more than 32.7 tons per foot. Reference to the Production Schedule supplied by the Company shows that a very considerable and increasing proportion of the development carried out from 1948 onwards will be between these levels. Development between the 800' and 1000' levels does not commence until February, 1949, and there is much scope for improvement before this work is done. All this adds up to the conclusion that if improved stoping methods are found to be practicable, the amount of development, and hence the amount of subsidy, required for the next two years might be considerably reduced. However, on the basis of present performance, the Company feels that the money asked for will be required. The fact that development requirements are still somewhat indefinite is one more reason, why, it is suggested, subsidy settlements should be made at the end of operating periods. There will be a need, of course, for the provision of operating funds.

Balanced against increases in efficiency is the prospect of an accelerated decline in the purchasing power of the Australian pound. It is doubtful whether the Company has fully considered the possible effects of this factor.

CONCLUSION.

It is considered that the Big Bell should not be regarded as a mine to be subsidised continuously and at an increasing rate. It is suggested that the Company be helped to continue for a period of two years from June, 1948. If at the end of that time, there are not marked improvements in operating results, it might be necessary to conclude that the cost of obtaining gold from this deposit is too high. To reach this conclusion now, when the company is suffering from lack of development and from other factors, partly due to war, and when it is in the throes of the changeover from surface to underground mining, would be opposed to the judgement of the Company's engineers and would probably be premature. On the other hand, if the Company is given to understand that the future of any subsidy depends on the attainment of increased efficiency, any suggestion of a "cost plus" system would be removed. If, at the end of two years' operation with sufficient capital, the mine did not show signs of becoming a profitable producer, it is doubtful if the Company itself would be keen to carry on. However, in order to plan a continuous and integrated programme, the Company would require some assurance that assistance would not be withdrawn too soon or too suddenly.

2nd July, 1948.
CANBERRA. A.C.T.

C. J. Sullivan
 (C.J. Sullivan)
Superintending Geologist.