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COMMONWEALTH OF AUSTRALIA.

DEPARTMENT OF SUPPLY AND SHIPPING.

BUREAU OF MINERAL RESOURCES GEOLOGY AND GEOPHYSICS.

REPORT No. 1948/33

SUPPLEMENTARY NOTES TO REPORT NO. 1948/16 ON SOME WESTERN AUSTRALIAN GOLD MINES

by

C.J. Sullivan
Superintending Geologist.

CANBERRA, A.C.T. 29th June, 1948.

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SUPPLEMENTARY NOTES TO REPORT NO. 1948/16
ON SOME WEST AUSTRALIAN GOLD MINES

REPORT NO. 1948/33

Boulder Perseverance Ltd.

These notes are supplementary to the report by J.A. Dunn, of 2/3/48, and the report by C.J. Sullivan of 27/2/48, and are designed to elucidate certain points brought up by the Treasury subsequent to the writing of those reports.

DROP IN GRADE, 1947.

The following table shows the head value of ore raised from 1939 to 1947, together with the estimated grade of the ore reserve for the preceding year:-

TABLE I.

Production			Ore Reserve Estimate. Previous Year dwt.
Year	Tons	Head Value dwt.	
1939	114,567	6.962	7.2 (1938)
1940	116,181	6.830	6.38 (1939)
1941	120,923	6.614	6.16 (1940)
1942	106,961	6.478	6.05 (1941)
1943	82,052	6.012	5.70 (1942)
1944	76,328	5.817	5.44 (1943)
1945	86,772	5.843	5.35 (1944)
1946	103,059	6.075	5.48 (1945)
1947	138,201	5.166	5.29 (1946)
			5.3 (1947)

The average grade for 1947 was 0.909 dwt. below that for 1946, but was close to the estimated grade of ore reserves in 1946, namely 5.29 dwt. In the preceding year, the grade had been pushed up by 0.595 dwt. above that of the ore reserves given in 1945, and this had the effect of unduly depleting the high-grade ore. The same had occurred to some extent in 1945. In 1947, it was necessary to return to the average of the ore reserves which is the only way in which a mine can be exploited continuously. The ore reserve grade for 1947 was 5.3 dwt. and it is expected that the ore mined during 1948 will approximate closely to this figure. However, exact predictions of the grade which will be obtained from a mine are not possible within 0.1 to 0.2 dwt. The drop in head value for 1947 does not, however, herald the depletion of the mine. There is not evidence that the mine could produce ore of a grade higher than 5.3 dwt. for any extended period.

As already stated, it is thought that the grade in 1948 should be close to 5.3 dwt. It is considered that while present mining costs last, it may be necessary to fix a lower limit of approximately 5.2 dwt. on the grade of ore to be mined from this deposit under any subsidy proposal. In order to conserve the life of the mine, and, at the same time maintain a

reasonable level of profit, the grade has been steadily moved down since 1935. The head value of ore from 1935 to 1947 is shown in the following tabulation:-

TABLE II

Year	Head Value dwt.	Operating Profit £	Year	Head Value dwt.	Operating Profit £
1935	8.754		1941	6.614	148,611
1936	8.216	102,735	1942	6.478	121,952
1937	8.290	155,698	1943	6.012	55,848
1938	7.751	169,301	1944	5.817	37,799
1939	6.962	162,560	1945	5.843	43,492
1940	6.830	160,753	1946	6.075	47,224
			1947	5.166	43,650

RATE OF DEVELOPMENT

The 1947 rate of development maintained production and increased reserves by 23,700 tons. Details are:-

Development feet	Ore Developed tons.	Ore Produced tons.	Excess of Ore Developed over Ore Produced. tons.
7,436	162,000	138,200	23,700

GENERAL.

There was a marked increase in efficiency in 1947 as against 1946, the tonnage per man shift underground being 2.28 for 1946 and 2.82 for 1947.

There was a marked increase in development and diamond drilling in 1947 as against 1946. This was necessary on account of the fairly moderate ore reserves of the mine (approximately 3 years).

There was a big labour turn-over during the year 1947; 241 men were engaged, and 223 were paid off. The average number of men employed was 352. Operating costs showed a decrease in 1947 over 1946, the figure for 1947 being 44/10.53 as against 46/7.83 for 1946.

Kalgoorlie Enterprise Ltd.

The questions asked by the Treasury concerning this mine referred to hydraulic stowing and to expenditure on development.

HYDRAULIC STOWING.

Careful inspection of the underground workings was made in company with the Management, and it was concluded that some method of supporting the walls of the stopes such as hydraulic stowing is absolutely necessary. This arises from the fact that the Greenhill Shoot, which is the main source of ore, is a flatly dipping deposit with a very bad hangingwall. The ore itself is also much faulted and broken, which would render it very dangerous to mine without adequate support. With mining methods such as shrinkage stoping, there would be very marked dilution from the barren hangingwall rock and the degree of danger to the miners would be too high. The Mines Department insists that the stope must be supported by some method of filling. It is clear also that the Management would not undertake the expense of hydraulic filling if it could be avoided because this adds approximately 10/- per ton to their mining cost and seriously affects their profit margin.

DEVELOPMENT.

The money spent on shaft sinking was not charged directly to income. The details of the allocation of this cost would be available to Messrs. Drummond and Pattison, who inspected the accounts of the mine. The cost of shaft sinking per ton in representative years has been as follows:-

1939	3/3.02
1945	0.78d.
1946	1/7 (78 feet shaft sinking)
1947	1/8

An important development cost on this mine is the north drive at the 2050' level to intersect the deeps of the North Kalgurli main lode. In 1947, of a total development footage of 4242', 513' were in this drive. The drive is 8' x 9' and costs nearly £10 per foot. From geological information available, this drivemay be considered as a rather speculative venture, but it is being carried out from a reserve fund created in previo s years. This money would normally have been distributed in dividends, and, since the Company, rather than distribute the money, decided to create a development reserve fund, it would seem that this matter does not now come up for consideration.

GENERAL.

The necessity to introduce stowage has had a marked effect on mining costs apart from the general increase experienced by all mines. These are shown by the following tabulation:-

	1939	1945	1946	1947
Ore Production	13/7.8	28/10.74	30/11	32/5
Development and diamond drilling.	5/3.86	6/2.68	5/0	7/11
Ore Transportation.	0/4.24	0/11.39	0/5	0/6
Other Expenses	1/11.57	2/2	1/11	1/9
Treatment.	11/1.61	14/10.93	15/2	14/6
	33/2	53/1.77	53/5	57/1

The rise in mining costs from 1945 as compared with 1939, is, to a considerable extent, due to the introduction of filling as against shrinkage stoping. The rise in milling costs of about 4/- per ton over 1939 figures, is, to a considerable extent, due to the marked increase in power costs, as well as in the cost of labour and materials.

The grade of the ore in this mine has been remarkably constant. From 1937 to 1947, the tonnage treated was as follows:-

Long Tons.	Average Grade.
545,450	6.615

A profit of some £300,000 was made from the treatment of this ore. The ore reserves and ore treated for the years 1945 to 1947 were as follows:-

Year	Ore Reserves		Production		Percentage Extracted.
	Tons	Grade	Tons	Grade	
1945	333,400	6.2	40,650	6.429	92.63
1946	310,700	6.21	52,034	6.778	93.34
1947	310,700	6.3	58,549	6.721	

The 1947 production was approximately 0.5 dwt. above the ore reserve grade for 1946. This occurred because a relatively rich patch was mined. It is anticipated that the grade in 1948 will be close to 6.3 dwt.

The development on the lowest level, No. 22, at 2175' has given very promising results, and the orebody appears to be persisting downwards very strongly. The property can be regarded as a good little mine capable of producing indefinitely approximately 5,000 tons per month. The "heavy" nature of the ground is the biggest drawback, and increases costs beyond what is normal on other mines.

COPY.

APPENDIX

Mines Department,
KALGOORLIE. W.A.

16th June, 1948.

The State Mining Engineer,
Mines Department,
PERTH. W.A.

KALGOORLIE ENTERPRISE LIMITED.

Your memo. of the 14th instant is acknowledged and in reply I herewith submit my opinion re the method of stope filling in the above mine.

I have during the past few years made inspections of this mine, and on two occasions the visits were made after we had ground snaps, and I was surprised to see the damage that had been caused to various levels and partly emptied shrink stopes, the location of the ore body in the mine lines up mostly with the cross lode sections that run through the South Kalgurli.

Prior to hydraulic filling being introduced great difficulty was experienced in maintaining the working levels in a good and safe condition.

It is noted that the Commonwealth Officers advised you that theyhad been told by other mining men in Kalgoorlie that shrink stoping would be satisfactory. In reply to that I am inclined to think that the people concerned did not know the mine or the conditions applying thereto.

A mine like the Enterprise, requires careful and sound supervision and management, shrink stoping in this mine was not a success yet in other mines the conditions of the ground and the orebody allow for shrink stoping to be carried out successfully.

Owing to the difficulties of holding their levels and to maintain an even payable grade of ore, which was difficult owing to the nature of the ground causing dilutions this Company in my opinion have done the correct thing and it is reasonable to state that the costs of hydraulic filling is a cheaper method, taking an over all cost per ton.

(Sgd.) J.H. VERRAN.
Senior Inspector of Mines.

South Kalgurli Consolidated

This report is supplementary to that of Dr. J.A. Dunn of 2/3/48 and that by Mr. C.J. Sullivan of 27/2/48.

RECOVERY AT CROESUS MILL.

The recovery at this plant is now 89%, and it is anticipated by the Management that it may be possible to obtain 90%. However, there are no real reasons for expecting a marked improvement in recovery. The low recovery is partly due to lack of pre-cyemidation. It was anticipated at the time of construction of the plant. It was apparently decided that the expenditure on plant and treatment costs to obtain a higher recovery would not have resulted in a nett saving.

CAPITALISATION OF DEVELOPMENT EXPENDITURE.

There has not been a large amount of shaft sinking which should have been charged to a capital account, and it is not considered that this point will greatly affect any subsidy to this mine.

PRODUCTION 1947.

Ore 79,521
Recovery 5.0 dwt.

FUTURE GRADE AND GENERAL PROSPECTS OF MINE.

In general, the statement given in my report of 29th February, 1948, can now be more fully substantiated. The Management is having a severe struggle to maintain a grade sufficiently high to pay expenses. The variation in the head value of the ore (per long ton) from 1934 to 1947 is as follows:-

Year	Head Value dwt.	Year	Head Value dwt.	Recovery
1934	11.85	1941	5.95	5.30
1935	7.42	1942	6.10	5.42
1936	7.87	1943	5.82	5.17
1937	6.55	1944	6.10	5.42
1938	5.90	1945	6.25	5.55
1939	5.34	1946	5.55	4.95
1940	5.55	1947	5.38	4.78

The grade for 1947 of 5.38 dwt. is just sufficient to cover expenses at the present time and there is a strong tendency for the grade to drop below this figure. In order to maintain the grade an unusually high proportion of ore has been drawn from the No. 2 cross-lode which is relatively high-grade. The reserves in this lode are as follows:-

	Tons.	Grade
Proved Ore	34,000	8.10
Probable Ore	9,500	-
	43,500	

At present, ore is being taken from this lode at the rate of 18,800 tons per annum, which would totally exhaust the ore in approximately two years' time. Judging from the reserve figures from the remaining lodes of this mine, the head value is likely to drop to the vicinity of 4.5 to 4.7 dwt. per long ton after this lode is exhausted provided no other high-grade

shoots are discovered. The No. 2 cross-lode was discovered in 1941 and was responsible for the increase in grade from that year onwards as compared with 1939 and 1940.

Mr. S.A. Tomich, Consulting Geologist, has recently completed a geological examination of this property and has recommended an extensive diamond drilling and development programme. The drilling recommended amounts to approximately 14,400 feet; the amount of development is not given definitely, but might amount to approximately 15,000 feet. This development and exploration programme is partly what would normally be undertaken by the Company, but also includes some longer range projects. Mr. Tomich has also recommended that the main shaft should be extended in depth. A decision would normally have to be made by the Board of Directors as to whether this programme will be undertaken or whether the mine will be treated more or less as a salvage proposition. It is understood that one of the London Directors is expected to visit Kalgoorlie with a view to making some decision about the future of the mine.

Regarding any subsidy that the Government may propose to pay to this mine, two important points emerge.

(a) Apart from the rising cost levels, the mine is in real difficulty from purely natural causes. It may be necessary to ensure that if the mine is subsidised, the average grade for a year's running should not be allowed to drop below, say, 4.75 dwt. per short ton, or 5.3 dwt. per long ton. It is apparent that during the years 1937 to 1940, when the mine was working under normal conditions, this grade was necessary for payable operation. If it is impossible for the mine to maintain production at approximately this grade, its demise could be considered to be due to natural causes rather than to current economic anomolies. While the ore in No. 2 cross-lode lasts, it should be possible to maintain the head value around 5.3 dwt. per long ton, and, as exploration proceeds, other high-grade shoots may be discovered. The proviso regarding grade would protect the Government's interests.

(b) The development programme suggested by Mr. Tomich is considered to be very sound, and to be based on good reasoning. However, it would be important to know whether the Company itself, under normal circumstances, would be prepared to undertake this programme, taking into account the chances of the mine for the future. It would be important to discuss this aspect with the visiting Director, who is believed to be a mining engineer. Although it is considered that the Government would necessarily have to help finance normal development to maintain the present ore reserve position, it could not be expected to finance a speculative programme on a mine such as the South Kalgurli.

At 31st March, 1948, the ore reserve position was as follows:-

	Long Tons.	Grade.
Positive Ore	189,500	5.65
Probable Ore	117,500	5.22
	307,000	5.50

At 31st March, 1947, comparable figures were:-

Total Reserves	312,000	5.54

For the year ended 31st March 1948, the result of development was as follows:-

Development. Ft.	Ore Developed. Long Tons	Percentage Payability	Tons per foot of Development
5,039	72,500	25%	14.5

These figures show that it would require about 5,000 feet of development per year to maintain the present ore reserves which amount to about 4½ years supply. The "percentage payability", or the proportion of development which found ore, is comparable with that obtained on the Great Boulder Mine, but the tons per foot of development is relatively low.

It is considered that any scheme of subsidy should include provision for 5,000 to 5,500 feet of development per year, and that if the Company desires to increase this development in order to carry out the recommendations of the geological survey, it should be asked to finance this work in whole or in part.

The Paringa Mine.

/as The position regarding ore reserves, the future of the deposit, and mining is substantially/stated in the report by C.J. Sullivan of 22.2.48.

The Management is finding it difficult to maintain output at 8,000 tons per month, the average production per four-weekly period from January 21st to June 8th, 1948, being 6,644 tons, containing 1,797 fine ounces gold. The average recovery was 1,548 fine ounces. These figures correspond to an average head value of 5.409 dwt. and an average recovery of 4.660 dwt. The mill recovery was 86.15 per cent.

The difficulty being experienced in maintaining production and grade is largely independent of the price of gold, the cost of supplies, etc., and is primarily due to the availability of ore supplies and the availability of manpower. The production from the commencement of operations to 31st August, 1947 was as follows:-

Long Tons.	Head Value dwt.	Recovery dwt.
807,663	5.567	4.90

For the year ended 31st August, 1947, the production was:-

Long Tons.	Head Value dwt.	Recovery dwt.	Percentage Recovery
107,195	5.246	4.583	87.32

The ore reserves at 2nd September, 1947, were as follows:-

	Long Tons	Head Value dwt.	Recoverable Grade dwt.
Ore Reserves 4 dwt. and over	120,666	5.75	5.05
Broken Ore in Stopes	119,109	4.02	3.50
	239,775	4.89	4.25

It will be noted that, on the figures supplied by the Management, the recovery from the present ore reserves is likely to be only 4.25 dwt. as against a recovery in the past of 4.9 dwt. and a recovery in 1947 of 4.58 dwt. However from January 21st to June 8th of this year, the average recovery was 4.66 dwt.

As pointed out in the previous report, the large orebodies which previously existed on this mine have been worked to the boundaries of the property and production is now being obtained from a number of small, very scattered shoots; these circumstances add to the cost of mining and exploration. It would not be economic to place mechanical equipment in these small scattered workings, and the cost of mining (23.25/- per ton), and development (7.85/- per ton) are fairly reasonable under the circumstances.

The difficulty of finding ore on this property is reflected in the results of development for the year ended 31st August, 1947. During this period, from 7,504 feet of development, 82,711 tons of ore were developed, or an average of a little over 11 tons per foot. This is the lowest figure for Kalgoorlie, and can be taken as an index of the response of the property to exploration. Mr. K.J. Finucane provides high-class geological

advice to the Company, though it is not certain that this advice is always accepted by the Management. At the present time, the Company is falling well behind with development and is able to undertake only about 350 feet per month or about 4,550 feet per annum, as against 7,500 for 1947. This is partly due to lack of money and partly due to lack of labour. The underground employees now work a 37.5 hour week as against 40 hours in pre-award days. Mr. Greenhill, the Manager, stated that he would be quite satisfied if the Government would subsidise him for possibly 5,000 feet of development per year, at £6 per foot, making a total of about £30,000 per annum. The mine undoubtedly requires some 7,000 to 8,000 feet of development per year.

It is apparent that this mine is faced with difficulties of a geological nature in addition to the other difficulties related to the present economic conditions. It is suggested that, if any subsidy is granted, the head value should be maintained at 5 dwt. or above, which would give a recovery of 4.35 dwt. or more. It is doubtful that even under 1938-1939 conditions the mine would have been payable at a grade much lower than this and had those conditions continued, and had the mine not been able to provide sufficient tonnage of ore of this grade, it would have been closed.

If development remains at its present level, and the response of the property also remains as at present, it is unlikely that the mine will be able to maintain output at around 8,000 tons per month for a period exceeding 18 months or two years.

In general, therefore, it is considered that the onus should be thrown on the Company to maintain output at a minimum of, say, 6,000 tons per month of a minimum grade of 5 dwt. with development limited to a maximum of about 8,000 feet per year. Lack of manpower and the shorter working week may render a production of 8,000 tons per month difficult to attain. If the Company cannot fulfil these conditions, any cessation of operations would be due to natural causes rather than to present economic conditions. It is fair to state that the Manager thinks that basically, the mine should be allowed to stand or fall, largely on its own merits. This was the basis of his suggestion that the Government could perhaps restrict its aid to the financing of certain development. If, at the end of one or two years, favourable ore-finding results had not been obtained, the mine would have to be regarded as uneconomic. In the past, the State Governments have frequently assisted mines on this basis. A representative of the State keeps a close watch on the development carried out and on the results obtained. It is believed that in this case, the suggestion has considerable merit, because the basic question to be answered is whether there is sufficient ore in the leases to maintain production at a reasonable cost per ounce.

Although it is stated above that, if a subsidy is granted on a more or less cost plus system, development would have to be limited to about 8,000 feet per year, the general tendency of mines in difficulties is to limit development out of economic necessity. It has generally been insisted by Government authorities assisting mining companies, that adequate development be carried out as this is vital to the continuance of operations. It also provides the best information regarding the probable value of the mine and enables the authorities to decide whether the assistance should be continued.

C. J. Sullivan.

29th June, 1948.
CANBERRA, A.C.T.

(C.J. Sullivan)
Superintending Geologist.