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— Engineering Features of Crown Point Loan —

by Alfred Merritt Smith, 1933-1934.

Late in the winter of 1933, Sutro Tunnel Coalition Incorporated Mining Company of Gold Hill, Nevada, on the Comstock Load, made application for a loan of $135,000.00 to P.W.A. for the purpose of:

1. Removing the V.N.T. rail road tracks from its present position above their mine and vein to a new location in order to permit them to mine the underlying ore.

2. For the construction of a modern flotation milling plant to mill the ores blocked out in the Crown Point Mine.

The Sutro Tunnel Coalition Company owns the Crown Point, the Kentuck, the Yellow Jacket and the Belcher mine of the Virginia City District, all of which were great producers during pioneer days.

The Company proposed to pay $1.50 per ton on all ores milled from the Crown Point and other mines until the loan was paid in full and also offered a first mortgage on the said mining property as additional security.

After careful study of the subject, ~~P.W.A.~~ we recommended a loan of $160,000.00 with the type of obligation being a contract to pay $1.75 per ton on all ores milled from the applicant's mines, with minimum annual payments so gauged that ~~whereby~~ the total loan and interest would be paid off by the end of 1940 at an average annual cost of $30,330.00.

The cost of the proposed project was estimated to be; $83,300.00, materials; $65,200, labor; other costs, $11,500.00; total $160,000.00; and it was computed that it would give employment to 85 men for six months and to 80 men during operation of the plant and mine. About this time, P.W.A. began to look with disfavor on private projects of all character excepting those of

semi-public nature such as loans to railroads ~~and~~ construction and improvements, toll bridges, etc. This being strictly a private enterprise was therefore declined by P.W.A. notwithstanding its merit. Not long afterward, Congressman J. G. Scrugham, former Dean of Engineering here at the University, originated and introduced an amendment to a bill then in the Seante, I believe Bill No. 3487, which amended the Reconstruction Finance Corporation Act and permitting the R.F.C. to make loans to the mining industry, based on known and sufficient mineral acreage or developed tonnage. Although there was opposition to this legislation, Congressman Scrugham's activity in its behalf carried the amendment to ~~the~~ successful conclusion and it is now a law. Additional effort is now being made by Congressman Scrugham towards modification and expansion of the law to enable small mines of promising mining specifications to secure loans, or at least to obtain some other or additional form of Government assistance than is possible under the present law because of lack of demonstrable or proven ore reserves to offer as security in most cases.

The cost of removing the railroad and making the proposed change was estimated at $58,250.00. The total cost of the new milling plant was estimated at $101,750. New mining equipment to the extent at least of $15,000.00 will be necessary, but the Mining Company stated that it was in a position to finance any necessary mine improvements without assistance.

The estimate of the P.W.A. Engineer for the cyaniding annex to the flotation mill, ~~was $125,000.00 higher than the estimate of the applicant.~~ 100-ton capacity, was $125,000.

The application for the Loan has been carefully prepared and included reports from Engineers who stand high in their respective professions. Surveys and estimates of the costs and the removal and allignment of the railroad tracks have been prepared by King & Malone of Reno. A report on the Crown Point Mine by F. M. Spencer, Mining Engineer, was also submitted. The report of Mr. Spencer did not include a personal sampling of the mine for, as is stated in the report, the main incentive was the consideration of the necessity of a change of allignment of the V.T. tracks rather than a detailed examination of the mine. This examination was carried far enough to show that the proposed change of the railroad was amply justified, and working of the mine would pay a profit. Mr. Spencer also made the railroad surveys and an excellent underground map of the mine. His Ore values were computed from mine records on file with the company.

An excellent report was also made by Mr. Howard W. Squires of Virginia City, who is imtimately associated with the well-known Arizona Comstock mines. Mr. Squires' report contains much history of early Comstock mining operations and the actual results of such operations obtained from records, and if it could be published, would be a valuable contribution to Comstock Lode Mining literature. Like the report of Mr. Spencer, little if any actual sampling of the Crown Point Mine was done, and the value of ore bodies blocked out had been computed from mine assays and records and to some extent from the returns of records of numerous ore shipments to various reduction companies and smelters, including the Mason Mine Company, International Smelting, Donovan Reduction Company of Silver City. The report also

contains a most excellent detail statement of milling costs based on much personal experince on the Comstock including the recent operations of the well-known Arizona Comstock Mill.

As stated before, the principal purpose of these reports was in general way to show that the removal of the railroad tracks from above the mine would be amply justified. I forgot to mention the principal item of the railroad work was a large cut calling for the excavation of 63,607 cubic yards at 75 cent per yard, total, $47,705.00

The application also included a report of preliminary ore tests and estimates of a cost of 100-ton flotation mill. One type of mill submitted can be erected for a fixed sum of $67,500.

It can be readily seen that the reports submitted with the application, valuable as they are, could not be acceptable to P.W.A. as a basis for computation of ore in sight to be used as security for a loan. Little or no personal sampling had been done by the engineers and no mill tests had been made by any organization not interested in the marketing of machinery. In view of the fact that the advisability of ore flotation treatment for all Comstock ores is gravely to be doubted, the necessity of a thorough sampling and careful preliminary tests by disinterested parties was ~~doomed advisable~~ imperative, for otherwise it is doubtful if an application for a loan would be considered by the Government.

The need of careful work by careful and thorough organizations was apparent. After discussing the matter with Mr. Robert Allen, State Eng. PWA, I took the subject up with Mr. John Fulton, Director of the Mackay School of Mines, who, fully realizing the value of such a project to

the State and the mining industry, assured me of and subsequently gave his fullest cooperation. Professor Walter Palmer of the Nevada State Analytical Laboratory, deemed the work of the highest value to the State, and contributed free State assaying of all ore samples. Mr. Allen communicated with Senator McCarran who secured the full cooperation of the U. S. Bureau of Mines, Reno Station, and Supervising Director, Mr. ~~Lever~~ Leaver. In the mine sampling, every assistance was given by Mr. James Leonard, the General Manager of the Company,

A sampling crew was organized under the direction of Mr. Robert Prince, and six upper classmen from the Mackay School of Mines. These men were driven out the mine each day from Reno and two men were put on each of the three levels and equipped with sampling tools and a map of the mine level. The work was directed by Mr. Prince and myself, and samples were cut across the vein and exposed ore bodies at the many points indicated on the map. Large channel samples were cut, broken down and quartered on a convass sheet. Eight days sufficed for the complete sampling of the blocked out ore bodies. Samples were brought in each day to the State Analytical Laboratory where Professor Palmer or Professor William Smithe prepared and assayed them. One hundred twenty-seven principal samples were taken as well as many special samples, the latter being taken for general information.

In the computation of ore in sight, the mine was divided into blocks as shown on the map and the tonnage and the average assay value of each block was computed separately. The total of these gave the quantity of exposed ore and its value.

The lowest workings in the mine ~~were~~ are at a vertical depth of 194 feet below the collar of the Yellow Jacket shaft which may be taken as the approximate ground surface. The old Yellowe Jacket shaft went down to below the 1200 foot level and from there were worked large bodies of ore from about the Sutro Tunnel horizon. Glancing at the map here will show the very small amount of ore on which this report is based as compared to the unexplored possibilities of these mines for ore of commercial grade at the present metal prices.

The net result of our work in the computation of the proven ore is as follows:

Total assured ore- - - - - - - - - -	114,000 tons.
Average value per ton ~~of~~ gold at $20.67 and silver at 40¢ - - - - -	$ 6.99
Average value per ton, the gold at $34.00 and silver 0.645¢ - - - - -	11.35.
Estimated mill recovery and milling equals - - - - - - - - - - - -	92.05, 10.51 per ton.
Total of ore costs per ton - - - - - -	5.80
Net profit per ton	4.71
Total profit on 114,000 tons - - -	536,940
Total proposed P.W.A. Loan principal	160,000
Total P.W.A. Loan interest	22,000
Makes a total of - - - - - - - - - -	182,000
net profit on ore in sight - - - -	345,940
Mill to treat	30,000 tons per year.

Time to mill ore in sight - - - -3 years and 10 months, say 4 years; probably additional ore 60,000 Tons, 2 years, possible addition of ore 800,000 Tons, 26 years.

Or summarizing another way, total recovery from ore in sight $1,198,140.00

Total recovery from ore in sight - - -		$1,198,140.00
Total mining and milling costs	661,200	
Loan and interest	182,000	
Total		843,200
Net profit		$ 354,940

~~As to~~ The permanence of this project, is dependent on additional ore reserves, which as pointed out, may be developed. The ore now in sight will last for four years of continuous operation. It is reasonably certain that additional ore will be developed to make a very much longer operation. The only planning on the future is covered in the amortization of the milling plant which is estimated at 23¢ per ton of ore treated over a period of fifteen years.

Of course, the mine afforded an unually good opportunity for estimating assured ore because mine development work had proceeded since 1928 without the extraction of ore, which has been prevented by the V.N.T. railroad Company.

EXPLANATION OF TERMS:

In the Crown Point Mine the lode, or vein fissure, is from 40 to 60 feet wide but not all of this material is ore. There is a ~~dip~~ of about 50 degrees to the vein, above the present bottom of the mine, which has ~~and~~ a depth of ~~about~~ 194 feet below the top of the old Yellow Jacket shaft. On the foot wall of this fissure is a vein or streak of ore or quartz ranging from two to six feet wide, having an approximate ~~valuation~~ value of $8.22 per ton. On the hanging wall side is another vein with an average width of five feet with a value of approximately $11.12

per ton. Between these two veins is a one of comparatively barren rock enriched at a few points where small cross fractures occur. Crosscuts have been run on some of these cross fractures, and are therefore mostly in ore, which might lead to an opinion that substantial ore bodies 40 or 50 feet wide exist, which is not the case in the exposed workings. The block between the foot-wall vein and the hanging-wall vein contains some bodies of minable ore on and adjacent to the cross fractures, but most of this central zone is waste rock. It may be well here to speak of the operation of the old United Comstock Mines Company, which built a great mill a short distance south of this point and after operating ~~for~~ a few years, met with failure. This Company controlled during its life, all of the group of old Gold Hill mines from the Alpha to the Overman, including all of the mines in the present Sutro Tunnel Colation. The failure, in 1924, of that company was due to grave m'stakes in mining, milling and general engineering. Low cost mining was attempted by a caving system to a main haulage tunnel about 2 miles long leading to the mill. As the gound cannot be successfuly cave mined, enormous aquantities of clay and waste rock diluted the ore. All of the great pit at Yellow Jacket, mostly waste, went to mill. The valuless clay prevented successful cyandiation of the already diluted ore. Judicious mining and a properly designed mill would have easily made the enterprise successful. Notwithstanding various serious errors in the entire set-up, the operation would have been successful under the present high price of gold and silver.

In the Crown Point Mine there is very little clay; the proven ore is is near the surface; the established value of the ore is good;

Mining and sorting of ore and waste will be simple and the cost low; tramming and hoisting are for short distances and comparatively low lifts; the method of ore treatment and design of mill have been outlined by acknowledge metallurgical authority, by thorough examination and careful preliminary tests. The errors made by the unfortunate United Comstock will be avoided. The ore is of more than double the value per ton of that milled by United Comstock, and all of the conditions are very much better. The addition of a cyanidation annex to the proposed flotation mill will insure a higher extraction of values and a substantial increase of total net profit. It is often true that the highest extraction will not lead to the highest net profit because of increased costs. This fact was probably in the minds of the Arizona Comstock Management when they built the present flotation mill. However, after a year of operation and it was found that t the addition of ~~the~~ cyanidation annex would ~~did~~ increase profits, and it is now being added to the mill.

Following is a summary of tonnages and values at Crown Point.

(Gold @ $34.00 and Silver at $0.64½ per oz., Troy)

Fill	14,652	tons	@	$15.16	per ton	$237,284.32
Footwall Vein	12,348	"	@	8.22	" "	101,500.50
Hangingwall Vein	85,952	"	@	11.12	" "	955,786.24
Totals & Average	113,952			$11.36		$1,294.571.12

Total Gross Value (as used in our estimates)
Average value per ton ore, $11.36 $1,294.571.12

Total Gross Value (old gold-silver prices)
Average value per ton ore, $6.99 $ 796.669.92

Discussion of "Fill."

Labor — Working conditions are excellent in all of the exposed workings. The ground is neither dusty nor wet, ventilation good and the mine cool, the gound breaks well; ore will be trammed a very short distance, an enclosed shaft, hoisted to the surface and dumped in bins directly behind the mill

Value - Gold, 0.195 oz Ton - $6.63 (@ $34.00
Silver 5.94 oz " 3.83 @ .645
$10.46.

ORE TESTS

A composite sample of ore was prepared from the 127 main samples as a basis for the tests. A considerable portion of the sample was oxide ore containing appreciable amounts of dark colored manganese and higher oxides. the sulphide content amounted to about 1 ½ percent, almost all pyrite. The first test was by straight amalgamation which gave an extraction of 46.2 % gold and 16% silver. It is evident that ~~it~~ nothing can be gained by preliminary amalgamation treatment because of this low extraction.

Straight cyanidation on dry crushed 40 mesh gave 92.4% gold and 53.6% silver. Cyanide loss 0.4 lb.

Lime loss 10 lbs.

Flotation gave 82.6% gold and 71.9 silver, ratio of concentration 37.5 to 1 .

Combined flotation and cyanidation of concentrate gave 81.4% gold and 65.1% silver. On straight cyanidation, minus 100-mesh gave results of 97.4% gold and 70.5% silver. Pretreatment of the ore with SO_2 ground to only 40 mesh give an extraction of 94.8% gold, 87.0% silver.

Without going into detail as to the tests, it was indicated that an extraction of 76.3% of all values could be obtained by

flotation alone, which would be the maximum with the type of mill contemplated by the applicant, to be built at a cost of approximately $67,500.

Flotation followed by cyanidation of the tailing will result in a total extraction of 92.5% which is an additional saving of $1.70 per ton. The net increase of saving after deducting 60¢ per ton, cost of cyanidation would be $1.10 per ton or $125,347.00 on the total ore in sight. It was estimated that a 100-ton filtration cyanidation annex to the proposed mill would cost about $25,000. It was reasoned that a cyanidation annex should be included in the plans for 3 reasons:

1. It will affect a substantial saving by increased extraction of gold and silver.

2. Variations in the character of the ore, which will undoubtedly occur, will not affect high extractions by means of a simple standardized mill practice.

3. It will insure a mill that will successfully treat both sulphide and oxidized ores of all types which may be encountered in the development of this group of mines, and also for the treatment of custom ore of any kind in the district, if it should be advisable to buy ores.

POSSIBLE ADDITIONAL ORE:

This report and the feasibility of the operation is based upon the tonnage of reasonably assured ore. No account has been taken of the possiblities of additional undeveloped ore. The adjacent mines, Belcher, Kentuck and Yellow Jacket, belonging to this company, as you will see by looking at this map, will show the very small ore of vein section which will worked by the present project. There is reason to believe that the gound to the north and south as well as a depth below the former main haulage tunnel of the United Comstock will yield great tonnages by intelligent mining.

Indeed, it is probable that this is of more importance than the present project and should lead to the employment of many men for years to come.

Following is a summary of what may be expected by the operation of the Crown Point Mine ~~un~~ under the proposed plan:

SUMMARY

114,000 tons ore (in round numbers) @ $11.36 per ton gross value. (Gold $34, Silver $.645)

Extraction, 92.5% $10.51; loss in residue per ton $0.85.

Total mining and milling costs $ 5.80

Net Profit per ton $ 4.71

Total Profit: $536,940

Total Profit, (as computed from U.S. Bureau of Mines Assays)

$587.640