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MR-050-02

PLACER MINING METHODS AND COSTS

in the

CIRCLE DISTRICT, ALASKA

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A thesis submitted as final requirement for the Degree of B. S.

Major Mining Engineering

Certificate of Acceptance

This thesis is approved as fulfilling the thesis requirement for graduation with the Degree of B. S.

Major Mining Engineering

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Dean of School of Mines

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Assoc. Prof. Mining Engineering

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Date

Acknowledgments

I wish to thank the operators in the Circle District for their willing cooperation in compiling the data for this paper and I am grateful to Mr. Henry R. Joesting for general information regarding the Circle District and his helpful suggestions.

I am indebted to Dean Ray J. Barber for reading and criticizing my manuscript and I tender special thanks to Prof. Livingston Wright for his cooperation in the preparation of this thesis.

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Introduction

When the attempt was made to ascertain the cost of mining in the Circle District it was found that many of the operators were not as interested in cost data concerning their operations as one would expect. They were mainly interested in whether or not their operation would net them a profit at the end of the season. A number of operators, especially the larger ones, have taken advantage of the services offered in Fairbanks by accountants who will do their cost accounting and act as purchasing agents for them. The charge is so nominal that the majority of the small operators could afford this service.

Besides the government requirement of accounts for taxation purposes the main reason for keeping a set of cost accounts is to enable the miner to spend his money efficiently. An accurate set of accounts enables him to compare the month to month and season to season costs of various operating expenses. From this comparison the operator can detect any increase of expense and take steps to remedy it. An almost equally important advantage lies in the ability to detect excessive operating costs through the comparison of various operating expenses with those of another company operating under similar conditions. Furthermore, accurate cost figures would, of course, be indispensable in the preparation of a budget. Cost accounts are invaluable to the operator in the expansion of his concern as they may be modified to apply to other districts.

> "The Circle District has been taken as the area lying between latitude 65°15' and 65°51' N. and longitude 143°53' and 145°47' W."[1]

The northern part of the district consists mostly of flat country embracing that part of the Yukon River known as the "Yukon Flats" and the southern part contains the high range of mountains through which Eagle Pass is the line of communication. In these mountains are Porcupine Dome (5,000 feet) and Mastodon Dome (4,000 feet), which contain the headwaters of Birch Creek.

The predominant rocks of this region are known as the Birch Creek schists. This group consists of recrystallized sedimentary rocks which include quartzite, quartzite schist, quartz-mica schist, mica schist, feldspathic and chloritic schists and a minor proportion of carbonaceous and calcareous schists and crystalline limestone. The associated meta-igneous rocks are gneiss, chlorite, albite, and sericite schists, amphibolite, and hornblende schist. The Birch Creek schist and probably most of the meta-igneous rocks associated with it are considered to be of pre-Cambrian age.[2]

In the Crazy Hills, which are on the northwest flank of the district, there occur some pre-Carboniferous Paleozoic rocks. For the most part, these are limestones but on the northern flank is some greenstone which is considered to be Carboniferous.[3]

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[1]J. B. Mertie, Jr., Gold Placers of the Fortymile, Eagle, and Circle Districts, Alaska, U. S. G. S. Bulletin No. 897-C, p. 134

[2]Ibid., p. 148

[3]Ibid., p. 149

Two Russian half-breeds, Pitka and Sorresco, made a strike on Birch Creek in 1893. At this time the first flurry of excitement was over in the Fortymile District, but many of the miners who wished to move on could not buy an outfit. Mr. McQuesten, a trader in the Fortymile District, offered to these men all the merchandise in his warehouse on credit. Eighty men took advantage of his offer. Upon arrival in this new mining district they built the town of Circle. The first town was built on a point twelve miles above the present site, but the next spring an ice jam caused the destruction of some of the cabins. The settlement was then moved to its present site. With the staking of Mastodon, Hog'em, Miller, Greenhorn, and Independence Creeks, Circle became one of the most important settlements in the Interior.

When all the freight for this region had to be transported up the Yukon River there was a freight charge of approximately $56.00 a ton on mining machinery from Seattle to Circle City. The freight was then taken to the various camps by horse teams for $200.00 a ton. Rough lumber cost $80.00, while dressed lumber was $125.00 a thousand board feet. Transportation of fuel oil from Seattle to Miller House cost $1.10 a gallon. With the opening of the Steese Highway, which connects Fairbanks and Circle, there came a decided reduction in the freight rates into the Circle District. Fuel oil can now be landed at Miller House at a total cost of $0.29 a gallon. Rough lumber is $40.00 a thousand at the sawmill at Ferry. The freight rate on mining machinery from Seattle to Fairbanks is $0.02 a pound, and from Fairbanks to the district it is approximately $0.015 a pound.

Before the reduction in the freight rates, the mining in this district was done mostly by drifting and only the higher grade gravels were hydraulicked. Today there is left only the marginal ground which requires more stripping. On most of the creeks there is sufficient water, but the amount available for sluicing is increased by the use of pumps which return the sluice water to the cut. The stripping is accomplished primarily by mechanical means. Thus, although there has been a reduction in the freight rates into this district, the cost per foot of mining has not been decreased proportionately. That is, on creeks where it was formerly possible to hydraulic the ground in the '20s for $0.50 a foot the ground is now being mined by modern mechanical methods at a cost of approximately $0.45 a foot.

The mining season for hydraulicking in this district is approximately 145 days; while mechanical mining, such as trestle mining, has a season of about 160 days.

Typical Mining Creeks

A brief description of a few of the creeks in the district will help to show the conditions under which the mining is done.

Mastodon Creek

Mastodon Creek, Independence Creek, and Miller Creek are the tributaries to Mammoth Creek, which joins Porcupine Creek just below Miller House to form Crooked Creek, which flows into the Yukon. Mastodon Creek and Independence Creek both head on the north side of Mastodon Dome, which is drained on the south side by the north fork of

Harrison Creek and Gold Dust Creek. The summit of Mastodon Dome has an elevation of 4,400 feet above sea level.

The main valley of Mastodon Creek may be said to begin at the junction of its two small headwater branches, the more easterly of which is known as 42 Gulch and the westerly as Fox Gulch. The elevation at this point in the valley is 2,600 feet. The gradient of Mastodon Creek ranges between three and five per cent. The gradient of the ground now being mined is approximately four per cent. About one-half mile below the junction of the headwater branches is the mouth of the East Fork of Mastodon, and one and one-half miles further downstream Baker's Gulch, another tributary of Mastodon Creek, enters from the southwest. Mastodon Creek has no other tributaries. The valley of Mastodon Creek is asymmetric in cross section with the steeper wall on the east side of the valley. This asymmetry, although not very noticeable in the extreme headwaters, becomes progressively accentuated downstream, and in places on the east side of the valley the rim rock is exposed. It is evident that in the erosion of its valley the creek has migrated laterally eastward, and although there are old channel remnants there, the creek, in its migration, has left no prominent terraces along the west side of the valley.

At its mouth the valley floor is about 400 yards wide, but approximately two miles upstream the valley narrows to half that width, and about three miles above its mouth it becomes still narrower. Farther upstream it widens somewhat for a distance of about a mile, when it narrows again to approximately 75 yards.

The bedrock on Mastodon Creek is mainly quartzite schist and mica schist. In places the surface oxidation has penetrated for a depth of four to five feet. In these places the pay does not seem to have entered the bedrock at all, but, where the bedrock is still blocky, it may have penetrated down to three feet. The usual dip of the schistosity is upstream. The bedrock contains in places small stringers of quartz which are doubtless of different ages. Some of these quartz veins, as well as mineralized zones in the bedrock, apparently are the source of some of the gold on the creek. The quartz veins are more plentiful toward the head of the creek.

Mr. J. B. Mertie, Jr.,[4] states that, since the gold in most of the commercial placers of Alaska is alloyed with some silver, as the gold progresses downstream from the source its fineness should progressively rise due to the chemical action of the water dissolving out the silver, during the continuous rehandling, and comminution. This holds for Mastodon Creek as the fineness of the gold is 740 at the head and 811 at the mouth. This evidence points to a local source of the majority of the gold at the head of the creek, although undoubtedly there has been some addition from the quartz stringers in the bedrock, and from the overburden.

On the flanks of the dome there are some mineralized quartz veins which, although containing sulphides of different base metals, do not seem to carry any free gold. No colors of gold can be panned from the

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[4]Mertie, op cit. I, p. 208

country rock, but since nuggets of gold with quartz attached are found in the creek it is probable that the mother lode of the placers in the vicinity of Mastodon Dome was the quartz veins, which have now been eroded down to the base ore. This view is supported by other evidence. There are numerous faults along the flanks of the Dome and the gouge in some places carries free gold. In the vicinity of these faults the overburden also contains colors. This evidence, coupled with the fact that the country rock apparently contains no free gold, would lead one to the conclusion that the faults penetrated the quartz veins before they were so deeply eroded as they are at present and while they still contained free milling ore. Slippage on the fault would tend to carry some values down to where they are now being exposed and eroded, thus continually supplying the overburden with colors.

The pay streak on Mastodon Creek seems to cover the whole creek valley bottom, and to continue for the full six miles of creek length, although in several places it does not contain enough pay to warrant working. The width of the pay streak is probably due to the meanderings of the creek at different stages. The fact that there is pay in all of the gravel and that it has not been concentrated into a definite pay-streak would suggest that the stream was being continuously fed with some gold. Fairly coarse gold has been panned high upon the rims of the creek. This was probably concentrated there during an earlier stage in the erosion of the valley.

The country rock in this vicinity is mainly schist, and the gravels on Mastodon, Miller and Independence Creeks are, for the most part, of this derivation. They contain, toward the head of the creek, numerous large quartz blocks and boulders of the country rock, which become smaller and more rounded downstream.

Independence Creek

Independence Creek heads on the northerly side of Mastodon Dome about one and one-half miles to the east of Mastodon Creek, which it roughly parallels for about five miles. These two creeks are the headwater branches of Mammoth Creek. The valley of Independence Creek, though asymmetric in cross section, differs from Mastodon Creek in that the northwest side is the steeper. Independence Creek has several small tributaries entering from the southeast, of which some carry gold, but the North Fork and some of the other tributaries are barren. The gravels of Independence Creek are well compacted like those of Mastodon Creek, being derived from the same type of country rock. Because of that, they cannot be effectively excavated with a dragline, but with the exception of about the lower one foot they work well under a nozzle.

The creek bottom, where it is being mined at the present time, is approximately 200 feet wide and the pay streak seems to cover the entire width. The gravels are overlain by approximately five feet of muck and brush. The pay gravels have an average depth of approximately six feet. Although some large boulders are found, they are the exception rather than the rule. The gold lies mainly in the mica and quartzite schist bedrock.

Mastodon, Independence, and Mammoth Creeks have been the site of active mining for the last forty years. The drifting, hydraulicking, and dredging during this time took the more lucrative gravels and left only the marginal ground for present workings. Many portions of these creeks, that have been drifted, are today being worked by open cut, mechanical, and hydraulic mining. Wimmler[5] states that the cost of hydraulicking in the district in 1926 was between 25¢ and 50¢ per cubic yard. Today, because of the added expense of returning the water, the cost is approximately $1.00 per cubic yard.

In the winter of 1912 a dredge, which became known as the Elmer dredge, was moved from Bonanza Creek in the Klondike to Mastodon Creek. This dredge, the first built in the Yukon Territory, operated during the season of 1912 and 1913, after which it was abandoned as unprofitable.

Portage Creek

Portage Creek is approximately one and one-half miles east of Circle Hot Springs. It is a relatively small creek and has few tributaries. The valley of Portage is approximately 200 feet wide and the pay streak seems to cover the entire valley bottom. Above the pay gravel is about two feet of overburden consisting of muck, fine gravel, small trees and brush.

The top two feet of the bedrock is broken and partly disintegrated. Only ten per cent. of the pay is in the gravel, the rest being found to a depth of as much as seven feet in the bedrock. The gravel on Portage Creek is approximately eight feet deep, and contains but few boulders larger than two feet in diameter. It is well compacted and so presents the same mining difficulties as do several other creeks in this district.

[5] W. L. Wimmler, Placer Mining Methods and Costs in Alaska, U. S. Bureau of Mines Bulletin No. 259, p. 161

Portage is one of the creeks that has not been worked much in the past because the pay was small and not confined to a narrow paystreak. Furthermore, portions of the creek were thawed and therefore not profitable for drift mining.

Ketchum Creek

Ketchum Creek, a tributary to Crooked Creek, lies about five or six miles east of Deadwood Creek. Unlike Deadwood Creek, less than one-half of its valley is within the hilly country. For the most part it has a meandering course through the Crooked Creek Flats. A large part of its bedrock is intrusive granite. The gravels are not as compacted as those of other creeks in the district; and its paystreak, though approximately 150 feet wide, is now being mined for a width of only 100 feet. No mining at all has been done on Ketchum Creek below where it enters the Crooked Creek Flats.

Deadwood Creek

Deadwood Creek has a larger valley than Independence Creek, and an airline length of about fifteen miles, which is probably the longest drainage of any of the Crooked Creek tributaries. The upper ten miles is bounded by hills, but the lower five miles meanders in the Crooked Creek Flats. In the uppermost five miles, Deadwood Creek receives several small tributaries from both the northwest and the southeast sides of its valley. This part of the valley is definitely asymmetric in cross section with the steeper wall on the southeast side. These tributaries include 16 Gulch, Switch Creek, and several other small unnamed creeks.

The gravels on Deadwood Creek average from two to twelve feet deep, and these are overlain with from four to six feet of muck and other overburden. The gravels are well compacted and mostly frozen, but contain so little interstitial ice that thaw points cannot easily be driven. This was found to be especially true at the lower camp of the Deadwood Mining Company.

The gold seems to be well distributed through the gravel and carries into the bedrock for approximately a foot, although in some places up to four feet has been taken up.

Deadwood Creek has been the scene of mining activity since the beginning of mining in the Circle District. The creek had already been worked both by drifting and hydraulicking when mechanical excavators began to work on the marginal gravels in two places. In 1936 a dredge was built on the lower part of the creek, but it has since been moved out of the district.

Harrison Creek

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Harrison Creek, a large tributary of Birch Creek, has two headwater forks, the North Fork and the South Fork. The South heads on the east flanks of Mastodon Dome and flows in a general easterly direction, while the North Fork heads in the divide called Harrison Summit. The entire creek has an airline length of approximately twenty miles. The gravels in this creek present the same difficulties to mining as do those on other creeks in this vicinity. Harrison Creek has a number of tributaries among which are Squaw Creek, Bottom

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Dollar, and Traverse Creek. All of these creeks are reported to carry pay and some mining has been done on all of them.

The bedrock[6] of Harrison Creek and its tributaries consists of the schistose rocks belonging to the Birch Creek series. Quartz veins in the bedrock occur as commonly as on Mastodon Creek. The gravel deposits range from four to twelve feet deep and have little or no muck overlying them. A large part of the gravel is unfrozen. The wash is of moderate size, although some boulders as large as two feet are occasionally uncovered. The gravel seems to be less compacted than on Mastodon or Independence Creeks. The majority of the gold is found in the lower three feet of gravel and in the bedrock.

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[6]Mertie, op cit. I, p. 232

Mining Conditions

The mining method now most important in this district is mechanical dry excavation by draglines in conjunction with elevated trestled devices. The gravel on a number of the creeks is so compact that it has to be loosened first by some means before the draglines can be used. A bulldozer is commonly employed for this purpose, supplemented in some places with a scarifier. Due to a lack of sufficient water for sluicing, return pumps are ordinarily used so that the water may be used over again.

Open cut methods of mining are preferred in order that the heat from the sun may thaw the gravel. Therefore, a large portion of the season's work must be stripped ahead so that it will be at least partly thawed by the time that it is to be mined. During the spring months, then, the gravel must be mined as fast as it thaws, if production is to be kept at a maximum. This working "on the frost" not only causes high maintenance charges but also results in a short life for the machinery, thereby necessitating a high rate of depreciation. This condition exists on many of the creeks for the first three months of the season, leaving only a month and a half when completely thawed gravel can be mined.

There is an analogous case where the mining is done by hydraulicking. During the spring "run-off" the water is so cold that it has very little thawing effect, and by the time it is warm enough for thawing it is almost gone. Splashing, or intermittent hydraulicking, is the result. To overcome this difficulty many of these operators have installed pumps for returning the sluice water to the cut, either to be used as wash water or to be piped direct to a nozzle. Tailings are then stacked mechanically. This is one of the reasons why the cost of hydraulicking is higher now than in the past.

The short season, the frozen gravel, the compactness of the gravel, the lack of sufficient water, and the excessive freight rates are principal causes of the high operating costs in this district.

Definitions

Total Cost

The figures for "total expense" and "total cost per cubic yard mined" for the given period include all expenses of the mining company with the exception of prospecting expense and interest.

Operating Cost

"Operating costs" for the various operations include fuel oil, lubricating oil, grease, repairs, operation labor, and depreciation. There seems to be some difference in opinion among accountants in regard to the inclusion of depreciation in operating costs. Locally the term "operating cost" includes depreciation, and throughout this study the local usage will be followed as closely as possible.

Depreciation

The term "depreciation" also has a variety of interpretations. The Accountants' Handbook[7] cites several definitions of depreciation. The first is:

> "Depreciation, according to the most widely accepted usage, is the decline in value in use of fixed tangible assets, particularly buildings and equipment."

The second definition, that used by the Interstate Commerce Commission, is:

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[7] W. A. Paton, Accountants' Handbook, p. 577

> "Depreciation is the loss in service value not restored by current maintenance and incurred in connection with the consumption or prospective retirement of property in the course of service from causes against which the carrier is not protected by insurance, which are known to be in current operation, and whose effect can be forecast with a reasonable approach to accuracy."

Another definition given is the

> "loss of useful value due to use, wear, exhaustion, and the normal effect of time and exposure to the elements."

Still another is the process of

> "spreading the value of a fixed asset over the accounting periods comprising its service life."

Finlay[8] has the following to say:

> "By depreciation, then, I mean current construction costs; improvements. Until a mine is dead and ready to be buried in a watery grave there are always expenses of this kind. Depreciation means literally the process of losing value: practically it means the exact opposite; it means expenses undertaken to counteract loss of value. I hear it asked, why is this not maintenance? It is maintenance. It only seems not to be maintenance because the items that compose these charges have the appearance of being new plant and not merely replacements of old plant."

He adds:

> "Ordinarily I put the period of initial capital expenditures as far back as possible and, unless the increase of capacity is very considerable, I charge off the yearly new construction to operating and call it depreciation."

When the definition of the Interstate Commerce Commission is compared with Mr. Finlay's it is seen that there is a direct conflict between them. That is, the Interstate Commerce Commission says that

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[8] J. R. Finlay, The Cost of Mining, pp. 42 and 44

depreciation is the loss in value which is not replaced by maintenance, whereas Mr. Finlay says that maintenance entirely replaces the value lost. In the case of a machine, it seems impossible to replace entirely the value with new parts because first, there will be some slightly worn parts which may not need replacing for some years, but in which there has been a definite decline in value. Second, Finlay does not take into consideration that improvements in models of the machinery would make it possible to purchase in the later life of the old machine a more efficient one at the same cost as the original. Therefore, it seems logical in the case of mining machinery, such as is found in the placer mines in Alaska, to consider them all as having an actual decline in value each year. It is this decline in value which in this study is termed "depreciation" and it will be calculated on an hourly basis. That is, the decline in value is equal to the purchase price, and the machine is ready to be scrapped after it has run a definite number of hours.

Operation

The charge to the "operation" is the actual charge for wages of the operator for the number of hours during which the machine was producing. In the case of a tractor, when the machine was not producing or was in the shop being repaired, the operator's wages for these hours were included in shop expense.

Repairs - Shop Expense and Materials

The item "Repairs - Shop Expense" includes the wages of the men repairing the machine, and the overhead of the shop.

Under "Repairs - Materials" is included the actual cost of repair parts which were put into that machine.

Fuel, Oil, and Grease

The charge to "Fuel", "Oil", and "Grease" is the actual cost of these items used in the machine during the time specified.

General (Wash Plant, etc.)

Under "General (Wash Plant, etc.)" is included not only the expense of the washing plant, but also the expense of other items, such as dead work and supervision, necessary to keep the mine running.

Freight, drayage, and warehousing charges have been included in all costs.

Right Limit and Left Limit

The terms "right limit" and "left limit" follow the local usage as meaning the area on the right or left hand when looking downstream.

Depletion

Depletion is calculated as the cost of the ground divided by the total number of cubic yards which will be moved during the entire life of the mine, multiplied by the number of cubic yards moved during the season.

Mining Company A

Company A at the present time is working only about one-half of the width of the valley bottom. The principal water is supplied at a maximum head of 150 feet by way of a ditch that heads about one mile upstream. Some additional water is brought into the pit, when available, from a small tributary creek. Up to about the first of July enough water is supplied by the ditch to run a four-inch nozzle; but from July to September, or until the rains begin, splashing is necessary. In the latter part of the season of 1938 a pumping unit was installed to return the water for re-use during the dry part of the season. This is an International PJD 80 Diesel engine direct-connected to a 12 x 14 IR pump. The water from the pumping unit may be run to a monitor or into the pit for wash water.

The company uses an RD 6 Caterpillar tractor, equipped with an Isaacson bulldozer, for stacking tailings, resetting, removing boulders from the pit, and stripping. It is also used in the pit at times of lower water to push the gravel toward the front.

The present practice is to mine the ground in cuts 100 to 125 feet long. They run three 8-hour shifts employing seven men -- one man on the tractor, two nozzle men on each of the morning and afternoon shifts, and one nozzle man on the graveyard shift. This night man pipes from the back end of the cut toward the throat of the box the gravel which is then run through on the other two shifts. During the low water this preparatory work is done by tractor during the afternoon shift.

The tailings are always stacked by the tractor. A deep sump is maintained at the end of the sluice so that as much of the fine material as possible will be left there instead of going into the return pond. The tractor then picks up the tailings from the sump and spreads them fanwise in the old cut.

The wings and boxes are made in twelve foot sections to facilitate the moving and resetting. The pump intake is a weir 8 ft. by 6 ft. in two compartments divided by a one inch screen.

The sluice boxes are 34 inches wide and 60 feet long. They are riffled with rails for about the first twenty feet. The lower forty feet is in block riffles which, though not preferred by the company, can be made during slack times from local materials.

MINING COMPANY A
Operating Expense
1938 (12,222 cu. yds.)
Season of 145 days

		Per Hr.	Per Yd.
Tractor -- Factor: 1600 hours			
Fuel	$ 467.48	$0.292	
Oil	182.25	0.114	
Grease	65.00	0.040	
Repairs -- Materials	1,250.00	0.781	
Shop Expense	720.00	0.450	
Operation	1,600.00	1.000	
Depreciation	1,024.00	0.640	
	5,308.73	3.317	$0.434
Light Plant -- Factor: 190 hours			
Gasoline	86.08	0.452	
Oil	12.15	0.064	
Depreciation	33.35	0.175	
	131.58	0.691	0.010
Pump -- Factor: 250 hours			
Fuel	218.37	0.873	
Oil	32.40	0.13	
Depreciation	625.00	2.50	
	875.77	3.503	0.072
General (Sluicing, etc.)			
Supervision	1,450.00		
Labor	3,480.00		
	4,930.00		0.403
Mess			
Supplies	873.95		
Labor	870.00		
Fuel	21.60		
Depreciation	31.00		
	1,796.55		0.147
			$1.066

Mess cost/man/meal $0.59

Total cubic yards stripped and mined = 12,222 cubic yards
Total cubic yards mined/20 hours = 84.3 cubic yards

MINING COMPANY A
Statement of Expense
1938

Operating Expense		
Fuel	$ 685.85	
Gasoline	86.08	
Oil	226.80	
Grease	65.00	
Repairs -- Material	1,250.00	
Shop Expense	720.00	
Operation - labor	6,530.00	
Depreciation	1,702.35	
Mess Expense	1,796.55	$13,062.63
Other Expenses		
Depletion	501.10	
Miscellaneous Operating Material	147.30	
Miscellaneous Operating Expense	516.19	1,164.59
Total Expense		$14,227.22

Operating Cost/cubic yard	$1.068
Total Expense/cubic yard	$1.163

MINING COMPANY A
Operating Expense
1939
Season of 148 days (15,470 cu. yds.)

Tractor -- Factor: 1,547 hours		Per Hr.	Per Yd.
Fuel	$ 845.35	$0.546	
Oil	141.75	0.091	
Grease	80.60	0.052	
Repairs -- Materials	1,175.00	0.759	
Shop Expense	821.00	0.53	
Operation	1,547.00	1.00	
Depreciation	990.08	0.64	
	5,600.78	3.618	$0.362
Light Plant -- Factor: 200 hours			
Gasoline	90.40	0.452	
Oil	19.44	0.097	
Depreciation	35.00	0.175	
	144.84	0.724	0.010
Pump -- Factor: 227 hours			
Fuel	182.70	0.805	
Oil	46.37	0.204	
Depreciation	567.50	2.50	
	796.57	3.509	0.051
General (Sluicing, etc.)			
Supervision	1,480.00		
Labor	3,552.00		
	5,032.00		0.325
Mess			
Supplies	1,048.02		
Labor	888.00		
Fuel	22.10		
Depreciation	31.00		
	1,989.12		0.128
			$0.876

Total Cubic Yards stripped and mined 15,470
Total Cubic Yards stripped and mined/20 hours 104.5

MINING COMPANY A
Statement of Expense
1939

Operating Expense		
Fuel	$1,028.05	
Gas	90.40	
Oil	207.56	
Grease	80.60	
Repairs -- Materials	1,175.00	
Shop	821.00	
Operation - labor	6,579.00	
Depreciation	1,592.58	
Mess Expense	1,989.12	$13,563.31
Other Expenses		
Depletion	634.27	
Miscellaneous Operating Material	168.59	
Miscellaneous Operating Expense	574.16	1,377.02
Total Expense		$14,940.33

Operating Cost/Cubic Yard	$0.877
Total Expense/Cubic Yard	$0.966

Mining Company B

The camp of Mining Company B is equipped to accommodate fifteen men. Accommodations include a shower bath, the water for which is piped 300 feet from one of the Creek's tributaries. This water is heated by a wood stove and stored in a 100-gallon tank. The cook house has a separate hot water system. Four of the men are quartered in a frame bunk-house, and the others in three framed tents, each of which can accommodate three men. Some of the employees have their own private wannigans at the camp.

The equipment on the property consists of two RD-8 Caterpillar tractors, a Bucyrus-Erie model 34B dragline powered by a D-13,000 Caterpillar power unit, a 12 x 14 Allis Chalmers pump direct-connected to a D-17,000 Caterpillar power unit; and two 5 x 4 Allis Chalmers pumps direct-connected to a D-4,000 Caterpillar power unit.

The washing plant comprises a dump box, or hopper, and eighty feet of sluice boxes mounted on a trestle set on bobs to facilitate moving. Except for the dump box the entire trestle is sheathed with lumber, which affords protection to the operators during cold weather. The gravel is washed into the sluice boxes by playing a stream of water from a four-inch nozzle into the hopper. All of the gravel is washed over a grizzly which discharges the coarse material out through the left side of the trestle. The sluice boxes have a grade of approximately 9 inches to 12 feet.

A shop is maintained at the camp to do all necessary work on the machinery. Equipment at the shop includes a 1,000 watt light plant, an electric arc welder, and a fifty ton hydraulic press. Also, there is an air-driven Alemite grease gun, which has a one-barrel capacity for delivery of eight pounds of grease per minute under three hundred pounds pressure. It has been found, during the past three years of operation, that small hand methods of greasing did not insure that the tractor rollers and idlers were filled with grease. A decided saving has resulted from this high pressure greasing.

Mining Company B uses the trestle and fill method of mining. The trestle is placed upon a fill which has been given the same grade as the creek bedrock. It is pulled upstream to each new setup with the "Hyster" of the tractor. If the fill is soft, the second tractor may be required to act as deadman for the first.

In recent practice the pump-water pipe line along the bank is connected across to the trestle by a solid unit branch pipe. While the trestle is being moved this is swung up by a chain block, and lowered in place at the next setting. A cut to bedrock is then made below the trestle to divert the water to the right limit. A drain is always kept open on this limit, through the tailings, for the water returning to the pond.

When mining on a new cut begins, the dragline is set up and starts digging on the right limit beside the trestle. This side is worked out first to establish a drain. Thus the dirt in the rest of the cut is kept dry. As the cut progresses, the dragline moves to the front of the trestle. The last of the gravel in the cut is mined while the dragline operates from a stool made of boulders which have been pushed upstream from the rock chute as the cut progressed.

The tractors push the dirt up to the dragline because the gravel is too hard for the bucket to dig without assistance. While the right limit is being pushed up by one of the tractors, the second tractor is pushing forward the gravel from the back end of the cut. This gravel is thus available to the dragline during rush times for quick dirt, or taken as the cut progresses. The next mining is done at the back of the cut by the second tractor for a width of 75 feet to 100 feet to a distance of about 100 feet upstream from the trestle, so as to prepare the place for the next successive setup. The back bank is left perpendicular so that the waste fill which is piled against it as the next support for the trestle will not dilute the new gravel. The exposed bedrock is then cleaned up and the fill started.

This procedure in mining the cut makes it possible to start the new fill without diluting any of the gravel or hindering the working of the remainder of the cut. From this time on, one tractor can keep the dragline busy because all of the dirt is within 150 feet. This leaves the other tractor free to work on the fill, or the stripping, and to take care of the tailings.

The tractor in the pit will be able to handle the tailings at first until they are so high that they need constant attention.

When the tailing pile becomes as high as the sluice box it is then pushed down by a tractor. This is not necessary during the first three days of mining. The next two days it is necessary to push them down only once a day. For the next four days they must be pushed down twice a day. From then on it is necessary to push them down every two or three hours and near the end of the cut one tractor will usually be kept continuously busy at this job.

In the center of the valley approximately four to five feet is stripped off at the present time and up to fifteen or twenty feet is stripped on the rims. The management tries to utilize the dragline in stripping the overburden along the rims, but this is not always possible for muck conditions sometimes prevent the building of a road on the sidehill solid enough to hold up the dragline. In this case the rims are stripped by the tractors. All the dirt that the tractors pull out is stacked in the middle of the projected cut so that it can be pushed in for the fill. This is usually done by the second tractor while the mining is going on in the cut below.

The first stripping is taken down to gravel. The gravel is then panned at approximately one foot intervals all the way down until pay begins to show. The surface is then smoothed out at this place. All the stripping which the tractors handle is used for fill. The creek is turned from side to side in order that the fill will not become too moist.

After the cut is cleaned up the two tractors are used for making the fill. At this time one may be taking out the extreme limits or the front corners, stacking them in the throat of the fill, while the other is engaged pushing them out. This obviates the necessity of making a sharp turn with a load. When the throat becomes too high or when the balance of the strippings are in the throat, both tractors work on the fill proper. This is accomplished by each tractor pushing out a load, one behind the other. As the leading tractor nears the end of the fill the one behind spreads its load. Because of differences in length of haul they do not always synchronize in this manner, and the tractor which is on the fill when the other starts down picks up a load from the material which has been spread and carries it out. If the fill becomes too high where the spread occurs, one of the tractors may stay out on the fill, making the short hauls necessary to bring it down level again. This method tends to make the fill too high, but if the operators use care it will remain level and in grade. At the outset it seems wasteful to be handling the material twice. However, a close analysis will show that unless one tractor works alone, doing the stripping and building the fill at the same time, the dirt must be handled at least twice. By the above method both tractors may be working through the throat and out on the fill without interfering with each other, and time is not lost making stock piles and building roads over them.

When it becomes necessary to bring up the return pond, a 300 or 325 foot cut is taken. The additional length of cut is necessary so that the tailings from the first cut above the new pond will not fill it. In making the return pond the fill is pushed both ways to dam up the entire creek. This is done by taking a slice directly down the fill and spreading it both ways against the last tailing pile. After the dam is built it is puddled, or sealed, satisfactorily by a tractor as the water rises.

The larger pump is used to return the sluicing water to the trestle. This is a 12 x 14 type S-J AC pump direct-connected to a D-17,000 Caterpillar power unit. The whole assembly is mounted on skids to facilitate moving. The fuel for this unit is served by a siphon line from a 500 gallon Caterpillar settling tank to the engine fuel tank, thus insuring against contamination by water and dirt.

The sluicing water from the trestle is caught in a return pond where the fine material is allowed to settle out before the water enters the weir. The intake of the weir is placed as far as possible from the point at which the sluice water enters the pond. At the present setup this is about 150 feet. The weir measures approximately 9 feet high, nineteen feet long and 10 feet wide inside. It is divided into two compartments by a screen made of 1 in. x 4 in. boards placed on edge and spaced 3/4 in. apart. The screen is slightly inclined from the perpendicular to facilitate the removal of any trash or debris which may collect there. The outlet compartment is entirely sealed from the pond, but has an outlet gate which can be raised separately or in conjunction with the flushing gate when the pond is flushed to remove any of the fines which may have settled around the intake to the pump. The pond is flushed as often as convenient. A head frame is built above the outlet gates to permit the use of a chain hdst in raising the gates for this purpose. The weir is covered both inside and out with 2 in. x 12 in. lumber and is built on two iron-shod skids so that it can be easily removed from the dam. Wings of 2 in. x 12 in. lumber are run out from each side of the weir for sixteen feet. The pumping unit is located directly behind the right wing. This arrangement requires only a short intake pipe to connect the pump with the weir and allows solid-unit bracing from the pump to the weir and from the wings to the pump.

The pipe line is laid from the pump along the left limit hillside to the trestle. The first 300 feet is of 20 in. diameter pipe, followed by 300 feet of 19 in. pipe, then by 18 in. pipe. The pipe line is extended each time the trestle is moved upstream. As much as 1300 feet of pipe have been used before it was found necessary to bring up the return pond.

The return pond must be periodically cleaned out. During the summer of 1938 it was the practice to have a tractor do it once a day. As this method proved to be very hard on rollers and idlers it was discontinued. Now the dragline is used for this work at the end of every cut. A decided saving on tractor rollers and idlers has been shown during the 1939 season. This is probably partially because the tractors have not had to clean the pond at the end of each shift. Also the tractors are free at least a half hour more each day. Another advantage in having the dragline do this cleaning is that the fines are stacked upon the tailing piles and thus they are not carried by the creek to the lower pond.

Situated approximately 3,200 feet below the camp is a smaller pumping plant. This is powered by a Caterpillar D-4,400 engine which is direct-connected to two 5 x 4 type S-J AC pumps, each of which has a rating of 500 gallons per minute at 500 foot head. Connections are supplied so that the outlet of one of the pumps can be connected to the intake of the other, making a two stage system capable of producing 250 gallons at 1,000 foot head. It is expected that this should be sufficient to return the water to the very end of pay gravel up the creek. The pump is situated just below a spring with a flow of approximately five miner's inches of water during the season when the creek is dry. Besides pumping the spring water, this pump also returns the water which has been lost by the flushing of the main return pond. With this arrangement it is possible for the company to operate during the dry season without a serious shortage of water.

MINING COMPANY B
Operation Record
1938
Season of 149 days

Cut No.	Area Sq. Ft.	Volume Cu. Yds.
1	48,600	32,400
2	48,600	32,400
3	48,600	32,400
4	45,220	30,180
5	40,000	26,630
6	45,000	30,000
7	38,250	25,502
	314,270	209,512

Cost/cubic yard stripped and mined:

Operating Expense/ cubic yard	$0.36
Total Expense/cubic yard	0.49

Cubic yards mined and stripped/20 hours -- 1,408

MINING COMPANY B
Sluicing Record
1938

Cut No.	Depth Feet	Area Sq. Ft.	Sluicing Days	Total Yards Sluiced	Cu. Yds./ 20 hours
1	12	48,600	20	21,600	1,080
2	12	48,600	23	21,620	940
3	12	48,600	24	21,600	900
4	12	45,220	16	20,800	1,255
5	12	40,000	10	17,780	1,778
6	12	45,000	11	19,976	1,816
7	12	38,250	13	16,445	1,265
		314,270	117	139,821	

Average yardage sluiced/20 hours = 1,195 cu. yds./20 hrs.

Cost per yard sluiced -- Operating Expense $0.544
Total Expense $0.740

MINING COMPANY B
Operating Costs
May, 1938

	Total Month	Per Hour	Per Cu. Yd. (17,820 Cu. Yds.)
Tractor No. 1 -- Factor: 229 hours			
Fuel	$ 332.51	$1.452	
Oil	22.44	0.098	
Grease	13.74	0.06	
Repairs -- Materials	938.90	4.10	
Shop Expense	320.60	1.40	
Operation	229.00	1.00	
Depreciation	206.10	0.90	
	2,063.29	9.010	
Tractor No. 2 -- Factor: 252 hours			
Fuel	365.90	1.452	
Oil	24.70	0.098	
Grease	15.12	0.06	
Repairs -- Materials	796.32	3.16	
Shop Expense	272.16	1.08	Total two tractors:
Operation	252.00	1.00	
Depreciation	226.80	0.90	
	1,953.00	7.750	$0.225
Dragline -- Factor: 165 hours			
Fuel	143.55	0.87	
Oil	26.40	0.16	
Grease	1.65	0.01	
Repairs -- Materials	77.55	0.47	
Shop Expense	37.95	0.23	
Operation	165.00	1.00	
Depreciation	165.00	1.00	
	617.10	3.74	0.033
Pump D-17,000 -- Factor: 194 hours			
Fuel	803.16	4.14	
Oil	21.34	0.11	
Repairs	62.08	0.32	
Operation	155.20	0.80	
Depreciation	174.60	0.90	
	1,216.38	6.27	0.069

MINING COMPANY B
Operating Costs
May, 1938

		Total Month	Per Hour	Per Cu. Yd. (17,820 Cu. Yds.)
Shop				
Shop Expense		$ 630.71		
Materials		1,874.85		
		2,505.56		
Distribution:				
Tractor No. 1	$1,259.50			
Tractor No. 2	1,068.48			
Dragline	115.50			
Pump	62.08			
	2,505.56			
General (Wash Plant, etc.)				
Supervision		150.00		
Labor		536.96		
		686.96		$0.038
Total				$0.365

MINING COMPANY B
Operating Costs
June, 1938

	Total Month	Per Hour	Per Cu. Yds. (41,345 Cu. Yds.)
Tractor No. 1 -- Factor: 446 hours			
Fuel	$ 647.59	$1.452	
Oil	43.71	0.098	
Grease	26.76	0.06	
Repairs -- Materials	1,828.60	4.10	
Shop Expense	624.40	1.40	
Operation	446.00	1.00	
Depreciation	401.40	0.90	
	4,018.46	9.010	
Tractor No. 2 -- Factor: 605 hours			
Fuel	878.46	1.452	
Oil	59.29	0.098	
Grease	36.30	0.06	
Repairs -- Materials	1,911.80	3.16	
Shop Expense	653.40	1.08	
Operation	605.00	1.00	Total two tractors:
Depreciation	544.50	0.90	
	4,688.75	7.750	$0.210
Dragline -- Factor: 624 hours			
Fuel	542.88	0.87	
Oil	99.84	0.16	
Grease	6.24	0.01	
Repairs -- Materials	293.28	0.47	
Shop Expense	143.52	0.23	
Operation	624.00	1.00	
Depreciation	624.00	1.00	
	2,333.76	3.74	0.056
Pump D-17,000 -- Factor: 416 hours			
Fuel	1,722.24	4.14	
Oil	45.76	0.11	
Repairs	133.12	0.32	
Operation	332.80	0.80	
Depreciation	374.40	0.90	
	2,608.32	6.27	0.063

MINING COMPANY B
Operating Costs
June, 1938

		Total Month	Per Hour	Per Cu. Yd. (41,345 Cu. Yds.)
Shop				
Shop Expense		$1,421.32		
Materials		4,166.80		
		5,588.12		
Distribution:				
Tractor No. 1	$2,453.00			
Tractor No. 2	2,565.20			
Dragline	436.80			
Pump	133.12			
	5,588.12			
General (Wash Plant, etc.)				
Supervision		300.00		
Labor		1,101.44		
		1,401.44		$0.034
Total				$0.363

MINING COMPANY B
Operating Costs
July, 1938

	Total Month	Per Hour	Per Cu. Yd. (38,035 Cu. Yds.)
Tractor No. 1 -- Factor: 488 hours			
Fuel	$ 708.58	$1.452	
Oil	47.82	0.098	
Grease	29.28	0.06	
Repairs -- Materials	2,000.80	4.10	
Shop Expense	683.20	1.40	
Operation	488.00	1.00	
Depreciation	439.20	0.90	
	4,396.88	9.010	
Tractor No. 2 -- Factor: 437 hours			
Fuel	634.52	1.452	
Oil	42.83	0.098	
Grease	26.22	0.06	
Repairs -- Material	1,380.92	3.16	
Shop Expense	471.96	1.08	Total two tractors:
Operation	437.00	1.00	
Depreciation	393.30	0.90	
	3,386.75	7.750	$0.204
Dragline -- Factor: 617 hours			
Fuel	536.79	0.87	
Oil	98.72	0.16	
Grease	6.17	0.01	
Repairs -- Material	289.99	0.47	
Shop Expense	141.91	0.23	
Operation	617.00	1.00	
Depreciation	617.00	1.00	
	2,307.58	3.74	0.063
Pump D-17,000 -- Factor: 456 hours			
Fuel	1,887.84	4.14	
Oil	50.16	0.11	
Repairs	145.92	0.32	
Operation	364.80	0.80	
Depreciation	410.40	0.90	
	2,859.12	6.27	0.076

MINING COMPANY B
Operating Costs
July, 1938

		Total Month	Per Hour	Per Cu. Yd. (38,035 Cu. Yds.)
Shop				
Shop Expense		$1,297.07		
Materials		3,817.63		
		5,114.70		
Distribution:				
Tractor No. 1	$2,684.00			
Tractor No. 2	1,852.88			
Dragline	431.90			
Pump	145.92			
	5,114.70			
General (Wash Plant, etc.)				
Supervision		310.00		
Labor		1,147.04		
		1,457.04		$0.038
Total				$0.381

MINING COMPANY B
Operating Costs
August, 1938

	Total Month	Per Hour	Per Cu. Yd. (56,810 Cu. Yds.)
Tractor No. 1 -- Factor: 549 hours			
Fuel	$ 797.15	$1.452	
Oil	53.80	0.098	
Grease	32.94	0.06	
Repairs -- Materials	2,250.90	4.10	
Shop Expense	768.60	1.40	
Operation	549.00	1.00	
Depreciation	494.10	0.90	
	4,946.49	9.010	
Tractor No. 2 -- Factor: 560 hours			
Fuel	813.12	1.452	
Oil	54.88	0.098	
Grease	33.60	0.06	
Repairs -- Materials	1,769.60	3.16	
Shop Expense	604.80	1.08	
Operation	560.00	1.00	Total two tractors:
Depreciation	504.00	0.90	
	4,340.00	7.750	$0.164
Dragline -- Factor: 638 hours			
Fuel	555.06	0.87	
Oil	102.08	0.16	
Grease	6.38	0.01	
Repairs -- Material	299.86	0.47	
Shop Expense	146.74	0.23	
Operation	638.00	1.00	
Depreciation	638.00	1.00	
	2,386.12	3.74	0.042
Pump D-17,000 -- Factor: 480 hours			
Fuel	1,987.20	4.14	
Oil	52.80	0.11	
Repairs	153.60	0.32	
Operation	384.00	0.80	
Depreciation	432.00	0.90	
	3,009.60	6.27	0.053

MINING COMPANY B
Operating Costs
August, 1938

		Total Month	Per Hour	Per Cu. Yd. (56,810 Cu. Yds.)
Shop				
Shop Expense		$1,520.14		
Materials		4,473.96		
		5,994.10		
Distribution:				
Tractor No. 1	$3,019.50			
Tractor No. 2	2,374.40			
Dragline	446.60			
Pump	153.60			
	5,994.10			
General (Wash Plant, etc.)				
Supervision		310.00		
Labor		1,155.20		
		1,465.20		$0.026
Total				$0.285

MINING COMPANY B
Operating Costs
September, 1938

	Total Month	Per Hour	Per Cu. Yd. (55,502 Cu. Yds.)
Tractor No. 1 -- Factor: 582 hours			
Fuel	$ 845.06	$1.452	
Oil	57.04	0.098	
Grease	34.92	0.06	
Repairs -- Material	2,386.20	4.10	
Shop Expense	814.80	1.40	
Operation	582.00	1.00	
Depreciation	523.80	0.90	
	5,243.82	9.010	
Tractor No. 2 -- Factor: 549 hours			
Fuel	797.15	1.452	
Oil	53.80	0.098	
Grease	32.94	0.06	
Repairs -- Material	1,734.84	3.16	
Shop Expense	592.92	1.08	
Operation	549.00	1.00	Total two tractors:
Depreciation	494.10	0.90	
	4,254.75	7.750	$0.171
Dragline -- Factor: 627 hours			
Fuel	545.49	0.87	
Oil	100.32	0.16	
Grease	6.27	0.01	
Repairs -- Material	294.69	0.47	
Shop Expense	144.21	0.23	
Operation	627.00	1.00	
Depreciation	627.00	1.00	
	2,344.98	3.74	0.042
Pump D-17,000 -- Factor: 444 hours			
Fuel	1,838.16	4.14	
Oil	48.84	0.11	
Repairs	142.08	0.32	
Operation	355.20	0.80	
Depreciation	399.60	0.90	
	2,783.88	6.27	0.050

MINING COMPANY B
Operating Costs
September, 1938

		Total Month	Per Hour	Per Cu. Yd. (55,502 Cu. Yds.)
Shop				
Shop Expense		$1,551.93		
Materials		4,557.81		
		6,109.74		
Distribution:				
Tractor No. 1	$3,201.00			
Tractor No. 2	2,327.76			
Dragline	438.90			
Pump	142.08			
	6,109.74			
General (Wash Plant, etc.)				
Supervision		300.00		
Labor		1,110.96		
		1,410.96		$0.025
Total				$0.288

MINING COMPANY B
Operating Costs
October, 1938

	Total Month	Per Hour	Per Cu. Yd. (51,080 Cu. Yds.)
Tractor No. 1 -- Factor: 140 hours			
Fuel	$ 203.28	$1.452	
Oil	13.72	0.098	
Grease	8.40	0.06	
Repairs -- Material	574.00	4.10	
Shop Expense	196.00	1.40	
Operation	140.00	1.00	
Depreciation	126.00	0.90	
	1,261.40	9.010	
Tractor No. 2 -- Factor: 138 hours			
Fuel	200.38	1.452	
Oil	13.52	0.098	
Grease	8.28	0.06	
Repairs -- Material	436.08	3.16	
Shop Expense	149.04	1.08	
Operation	138.00	1.00	Total two tractors:
Depreciation	124.20	0.90	
	1,069.50	7.750	$0.046
Dragline -- Factor: 252 hours			
Fuel	219.24	0.87	
Oil	40.32	0.16	
Grease	2.52	0.01	
Repairs -- Material	118.44	0.47	
Shop Expense	57.96	0.23	
Operation	252.00	1.00	
Depreciation	252.00	1.00	
	942.48	3.74	0.019

MINING COMPANY B
Operating Costs
October, 1938

		Total Month	Per Hour	Per Cu. Yd. (51,080.Cu. Yds.)
Shop				
Shop Expense		$ 403.00		
Materials		1,128.52		
		1,531.52		
Distribution:				
Tractor No. 1	$ 770.00			
Tractor No. 2	585.12			
Dragline	176.40			
	1,531.52			
General (Wash Plant, etc.)				
Supervision		120.00		$0.002
		120.00		
Total				$0.067

MINING COMPANY B
Operating Expense
1938

MESS
(Season of 149 days)

Supplies	$3,209.20
Labor	1,206.36
Fuel	23.00
Depreciation	71.36
	$4,509.92

Cost/cubic yard	$0.022
Cost/man/meal - 14 men	$0.72

MINING COMPANY B
1938

Statement of Expense

Operating Expenses:		
Fuel	$18,005.31	
Oil	1,174.13	
Grease	327.73	
Repairs -- Material	20,019.57	
Shop Expense	6,824.17	
Operation - Labor	16,031.60	
Depreciation - Equipment	9,191.50	
Mess Expense	4,509.92	$ 76,083.93
Other Expenses:		
Depletion	18,714.81	
Miscellaneous Operating Material	5,423.21	
Miscellaneous Operating Expense (includes taxes and insurance)	5,342.24	
Accounting & Engineering	1,370.00	30,850.26
		106,934.19
Less Deferred Stripping		3,393.38
Total Expense		$103,540.81

MINING COMPANY B
Operation Record
1939
Season of 139 days

Cut No.	Area Sq. Ft.	Volume Cu. Yds.
1	56,000	42,222
2	56,000	42,222
3	41,000	34,481
4	30,000	22,222
5	45,000	30,000
6	32,000	20,148
7	57,000	31,667
8	33,000	14,667
9	30,000	13,333
Stripping for season 1940		15,000
Total		265,962

Cost/cubic yard stripped and mined:
Operating Expense/cubic yard $0.27
Total Expense/cubic yard $0.42

Cubic yards stripped and mined/20 hours 1,915 cu. yds.

MINING COMPANY B
Sluicing Record
1939

Cut No.	Depth Sluiced	Area Sq. Ft.	Sluicing Days	Total Yards Sluiced	Cu. Yds./ 20 hours
1	12	56,000	18	24,888	1,383
2	12	56,000	20	24,888	1,244
3	10	41,000	12	15,185	1,265
4	8	30,000	8	8,889	1,111
5	7	45,000	9	11,667	1,296
6	6	32,000	8	7,111	889
7	5	57,000	9	10,556	1,173
8	4	33,000	6	4,889	815
9	4	30,000	4	4,444	1,111
			94	112,517	

Average yardage sluiced/20 hours 1,195 cu. yds.

Cost/cubic yard sluiced:
Operating Expense/cubic yard $0.64
Total Expense/cubic yard $0.99

MINING COMPANY B
Operating Costs
May, 1939

	Total Month	Per Hour	Per Cu. Yd. (30,498 Cu. Yds.)
Tractor No. 1 -- Factor: 136 hours			
Fuel	$ 197.20	$1.45	
Oil	9.52	0.07	
Grease	24.48	0.18	
Repairs -- Materials	548.08	4.03	
Shop Expense	210.80	1.55	
Operation	136.00	1.00	
Depreciation	122.40	0.90	
	1,248.48	9.18	
Tractor No. 2 -- Factor: 416 hours			
Fuel	603.20	1.45	
Oil	29.12	0.07	
Grease	74.88	0.18	
Repairs -- Materials	1,044.16	2.51	
Shop Expense	424.32	1.02	
Operation	416.00	1.00	Total two tractors:
Depreciation	374.40	0.90	
	2,966.08	7.13	$0.138
Dragline -- Factor: 252 hours			
Fuel	161.28	0.64	
Oil	30.24	0.12	
Grease	2.52	0.01	
Repairs -- Materials	191.52	0.76	
Shop Expense	35.28	0.14	
Operation	252.00	1.00	
Depreciation	252.00	1.00	
	924.84	3.67	0.03
Pump D-17,000 -- Factor: 176 hours			
Fuel	596.64	3.39	
Oil	7.04	0.04	
Repairs	49.98	0.284	
Operation	140.80	0.80	
Depreciation	158.40	0.90	
	952.86	5.414	0.031

MINING COMPANY B
Operating Costs
May, 1939

		Total Month	Per Hour	Per Cu. Yd. (30,498 Cu. Yds.)
Shop				
Shop Expense		$ 670.40		
Materials		1,833.74		
		2,504.14		
Distribution:				
Tractor No. 1	$ 758.88			
Tractor No. 2	1,468.48			
Dragline	226.80			
Pump	49.98			
	2,504.14			
General (Wash Plant, etc.)				
Supervision		300.00		
Labor		483.00		
		783.00		$0.026
Total				$0.225

MINING COMPANY B
Operating Costs
June, 1939

	Total Month	Per Hour	Per Cu. Yd. (53,952 Cu. Yds.)
Tractor No. 1 -- Factor: 580 hours			
Fuel	$ 841.00	$1.45	
Oil	40.60	0.07	
Grease	104.40	0.18	
Repairs -- Materials	2,337.40	4.03	
Shop Expense	899.00	1.55	
Operation	580.00	1.00	
Depreciation	522.00	0.90	
	5,324.40	9.18	
Tractor No. 2 -- Factor: 499 hours			
Fuel	723.55	1.45	
Oil	34.93	0.07	
Grease	89.82	0.18	
Repairs -- Materials	1,252.49	2.51	
Shop Expense	508.98	1.02	
Operation	499.00	1.00	Total two tractors:
Depreciation	449.10	0.90	
	3,557.87	7.13	$0.165
Dragline -- Factor: 595 hours			
Fuel	380.16	0.64	
Oil	71.28	0.12	
Grease	5.94	0.01	
Repairs -- Materials	451.44	0.76	
Shop Expense	83.16	0.14	
Operation	594.00	1.00	
Depreciation	594.00	1.00	
	2,179.98	3.67	0.04
Pump D-17,000 -- Factor: 441 hours			
Fuel	1,494.99	3.39	
Oil	17.64	0.04	
Repairs	125.24	0.284	
Operation	352.80	0.80	
Depreciation	396.90	0.90	
	2,387.57	5.414	0.044

MINING COMPANY B
Operating Costs
June, 1939

		Total Month	Per Hour	Per Cu. Yd. (53,952 Cu. Yds.)
Shop				
Shop Expense		$1,491.14		
Materials		4,166.57		
		5,657.71		
Distribution:				
Tractor No. 1	$3,236.40			
Tractor No. 2	1,761.47			
Dragline	534.60			
Pump	125.24			
	5,657.71			
General (Wash Plant, etc.)				
Supervision		300.00		
Labor		1,087.20		
		1,387.20		$0.026
Total				$0.275

MINING COMPANY B
Operating Costs
July, 1939

	Total Month	Per Hour	Per Cu. Yd. (71,703 Cu. Yds.)
Tractor No. 1 -- Factor: 490 hours			
Fuel	$ 710.50	$1.45	
Oil	34.30	0.07	
Grease	88.20	0.18	
Repairs -- Materials	1,974.70	4.03	
Shop Expense	759.50	1.55	
Operation	490.00	1.00	
Depreciation	441.00	0.90	
	4,498.20	9.18	
Tractor No. 2 -- Factor: 522 hours			
Fuel	756.90	1.45	
Oil	36.54	0.07	
Grease	93.96	0.18	
Repairs -- Materials	1,310.22	2.51	
Shop Expense	532.44	1.02	
Operation	522.00	1.00	Total two tractors:
Depreciation	469.80	0.90	
	3,721.86	7.13	$0.115
Dragline -- Factor: 595 hours			
Fuel	380.80	0.64	
Oil	71.40	0.12	
Grease	5.95	0.01	
Repairs -- Materials	452.20	0.76	
Shop Expense	83.30	0.14	
Operation	595.00	1.00	
Depreciation	595.00	1.00	
	2,183.65	3.67	0.030
Pump D-17,000 -- Factor: 460 hours			
Fuel	1,559.40	3.39	
Oil	18.40	0.04	
Repairs	130.64	0.284	
Operation	368.00	0.80	
Depreciation	414.00	0.90	
	2,490.44	5.414	0.035

MINING COMPANY B
Operating Costs
July, 1939

		Total Month	Per Hour	Per Cu. Yd. (71,703 Cu. Yds.)
Shop				
Shop Expense		$1,375.24		
Materials		3,867.76		
		5,243.00		
Distribution:				
Tractor No. 1	$2,734.20			
Tractor No. 2	1,842.66			
Dragline	535.50			
Pump	130.64			
	5,243.00			
General (Wash Plant, etc.)				
Supervision		300.00		
Labor		1,120.00		
		1,420.00		$0.020
Total				$0.200

MINING COMPANY B
Operating Costs
August, 1939

	Total Month	Per Hour	Per Cu. Yd. (49,764 Cu. Yds.)
Tractor No. 1 -- Factor: 509 hours			
Fuel	$ 738.05	$1.45	
Oil	35.63	0.07	
Grease	91.62	0.18	
Repairs -- Materials	2,051.27	4.03	
Shop Expense	788.95	1.55	
Operation	509.00	1.00	
Depreciation	458.10	0.90	
	4,672.62	9.18	
Tractor No. 2 -- Factor: 557 hours			
Fuel	807.65	1.45	
Oil	38.99	0.07	
Grease	100.26	0.18	
Repairs -- Materials	1,398.07	2.51	
Shop Expense	568.14	1.02	
Operation	557.00	1.00	Total two tractors:
Depreciation	501.30	0.90	
	3,971.41	7.13	$0.174
Dragline -- Factor: 590 hours			
Fuel	377.60	0.64	
Oil	70.80	0.12	
Grease	5.90	0.01	
Repairs -- Materials	443.40	0.76	
Shop Expense	82.60	0.14	
Operation	590.00	1.00	
Depreciation	590.00	1.00	
	2,165.30	3.67	0.044
Pump D-17,000 -- Factor: 420 hours			
Fuel	1,423.80	3.39	
Oil	16.80	0.04	
Repairs	119.28	0.284	
Operation	336.00	0.80	
Depreciation	378.00	0.90	
	2,273.88	5.414	0.046

MINING COMPANY B
Operating Costs
August, 1939

		Total Month	Per Hour	Per Cu. Yd. (49,764 Cu. Yds.)
Shop				
Shop Expense		$1,439.69		
Materials		4,017.02		
		5,456.71		
Distribution:				
Tractor No. 1	$2,840.22			
Tractor No. 2	1,966.21			
Dragline	531.00			
Pump	119.28			
	5,456.71			
General (Wash Plant, etc.)				
Supervision		300.00		
Labor		1,152.00		
		1,452.00		$0.029
Total				$0.293

MINING COMPANY B
Operating Costs
September, 1939

	Total Month	Per Hour	Per Cu. Yd. (51,163 Cu. Yds.)
Tractor No. 1 -- Factor: 582 hours			
Fuel	$ 843.90	$1.45	
Oil	40.74	0.07	
Grease	104.76	0.18	
Repairs -- Materials	2,345.46	4.03	
Shop Expense	902.10	1.55	
Operation	582.00	1.00	
Depreciation	523.80	0.90	
	5,342.76	9.18	
Tractor No. 2 -- Factor: 562 hours			
Fuel	814.90	1.45	
Oil	39.34	0.07	
Grease	101.16	0.18	
Repairs -- Materials	1,410.62	2.51	
Shop Expense	573.24	1.02	
Operation	562.00	1.00	Total two tractors:
Depreciation	505.80	0.90	
	4,007.06	7.13	$0.183
Dragline -- Factor: 616 hours			
Fuel	394.24	0.64	
Oil	73.92	0.12	
Grease	6.16	0.01	
Repairs -- Materials	468.16	0.76	
Shop Expense	86.24	0.14	
Operation	616.00	1.00	
Depreciation	616.00	1.00	
	2,260.72	3.67	0.044
Pump D-17,000 -- Factor: 450 hours			
Fuel	1,525.50	3.39	
Oil	18.00	0.04	
Repairs	127.80	0.284	
Operation	360.00	0.80	
Depreciation	405.00	0.90	
	2,436.30	5.414	0.048

MINING COMPANY B
Operating Costs
September, 1939

		Total Month	Per Hour	Per Cu. Yd. (51,163 Cu. Yds.)
Shop				
Shop Expense		$1,561.58		
Materials		4,352.04		
		5,913.62		
Distribution:				
Tractor No. 1	$3,247.56			
Tractor No. 2	1,983.86			
Dragline	554.40			
Pump	127.80			
	5,913.62			
General (Wash Plant, etc.)				
Supervision		300.00		
Labor		1,080.00		
		1,380.00		$0.027
Total				$0.302

MINING COMPANY B
Operating Costs
October, 1939

	Total Month	Per Hour	Per Cu. Yds. (8,888 Cu. Yds.)
Tractor No. 1 -- Factor: 40 hours			
Fuel	$ 58.00	$1.45	
Oil	2.80	0.07	
Grease	7.20	0.18	
Repairs -- Material	161.20	4.03	
Shop Expense	62.00	1.55	
Operation	40.00	1.00	
Depreciation	36.00	0.90	
	367.20	9.18	
Tractor No. 2 -- Factor: 40 hours			
Fuel	58.00	1.45	
Oil	2.80	0.07	
Grease	7.20	0.18	
Repairs -- Materials	100.40	2.51	
Shop Expense	40.80	1.02	
Operation	40.00	1.00	Total two tractors:
Depreciation	36.00	0.90	
	285.20	7.13	$0.073
Dragline -- Factor: 80 hours			
Fuel	51.20	0.64	
Oil	9.60	0.12	
Grease	.80	0.01	
Repairs -- Materials	60.80	0.76	
Shop Expense	11.20	0.14	
Operation	80.00	1.00	
Depreciation	80.00	1.00	
	293.60	3.67	0.033
Pump D-17,000 -- Factor: 60 hours			
Fuel	203.40	3.39	
Oil	2.40	0.04	
Repairs	17.04	0.284	
Operation	48.00	0.80	
Depreciation	54.00	0.90	
	324.84	5.414	0.037

MINING COMPANY B
Operating Costs
October, 1939

		Total Month	Per Hour	Per Cu. Yd. (8,888 Cu. Yds.)
Shop				
Shop Expense		$114.00		
Materials		339.44		
		453.44		
Distribution:				
Tractor No. 1	$223.20			
Tractor No. 2	141.20			
Dragline	72.00			
Pump	17.04			
	453.44			
General (Wash Plant, etc.)				
Supervision		150.00		
Labor		144.00		
		294.00		$0.033
Total				$0.176

MINING COMPANY B
Operating Expense
1939

MESS
Season of 139 days

Supplies	$3,096.53
Labor	1,195.25
Fuel	25.60
Depreciation	71.36
	$4,388.74

Cost/Cubic Yard	$0.017
Cost/man/meal - 15 men	$0.73

MINING COMPANY B
Statement of Expense
1939

Operating Expense		
Fuel	$15,701.86	
Oil	752.83	
Grease	915.21	
Repairs -- Materials	18,576.57	
Shop Expense	6,652.05	
Operation - Labor	15,981.80	
Depreciation	8,973.00	
Mess Expense	4,388.74	$71,942.06
Other Expenses		
Depletion	23,670.62	
Miscellaneous Operating Supplies	5,637.48	
Miscellaneous Operating Expense (taxes, insurance, auto, etc.)	6,426.24	
Accounting & Engineering	1,250.00	36,984.34
		108,926.40
Add 1938 deferred stripping	3,393.38	
Less 1939 deferred stripping	1,085.15	2,308.23
Total Expense		$111,234.63

Mining Company C

The gravel worked by Company C is so compact that it must be loosened before the dragline bucket can dig it. This is accomplished by an Isaacson three-tooth scarifier.

It has been the custom in the past to loosen the gravel with the scarifier and then bulldoze the loose material to the dragline, but now an effort is being made to have the dragline dig the loose material without previous bulldozing. Taking short cuts, the dragline starts digging on the right limit as far out as possible while still within reach of the hopper. This not only establishes the drain, but allows the rocks to be dumped on the bare bedrock of the last cut. The dragline then works itself around to the left limit side of the trestle, while the bulldozer follows to clean the bedrock. The last dragline setup is right on the bedrock. Thus, the tractors need only push up the extreme limits and the corners of the pit, while the tailings and the rocks can be pushed ahead as a fill for the trestle. Thus, when the cut is completed, the fill is approximately six feet high, and the trestle can be immediately moved to the new setup.

The trestle is built of fabricated steel without any housing, and rests on skids. It consists of a hopper and sixty feet of sluice boxes 34 inches wide.

The sluicing water is caught in a settling pond and returned to the trestle by a 10 x 14 AC pump which has a rating of 4,000 gallons per minute at an eighty foot head. The pump is direct-connected to a PJD 80 power unit. The return pipe line follows the left limit to the trestle.

One tractor is kept continuously busy stacking tailings.

Equipment on the property includes an RD 7 Caterpillar tractor and a TD 40 International tractor, both of which are equipped with Isaacson bulldozers. The P & H dragline, which is driven by a D-11,000 Caterpillar power unit, has a bucket of one yard capacity.

MINING COMPANY C
Operating Expense
1938
(Season of 98 days)

	Total Season	Per Hour	Per Cu. Yd. (76,111 Cu. Yds.)
Tractor No. 1 -- Factor: 1,130 hours			
Fuel	$ 474.60	$0.42	
Oil	101.70	0.09	
Grease	22.60	0.02	
Repairs - Material	2,870.20	2.54	
Shop Expense	768.40	0.68	
Operation	1,130.00	1.00	
Depreciation	1,130.00	1.00	
	6,497.50	5.75	
Tractor No. 2 -- Factor: 686 hours			
Fuel	802.62	1.17	
Oil	75.46	0.11	
Grease	48.02	0.07	
Repairs - Material	1,303.40	1.90	
Shop Expense	102.90	0.15	
Operation	686.00	1.00	Total two tractors:
Depreciation	583.10	0.85	
	3,601.50	5.25	$0.133
Dragline -- Factor: 1,065 hours			
Fuel	873.30	0.82	
Oil	127.80	0.12	
Grease	10.65	0.01	
Repairs - Material	3,109.80	2.92	
Shop Expense	191.70	0.18	
Operation	1,065.00	1.00	
Depreciation	958.50	0.90	
	6,336.75	5.95	0.083
Pump -- Factor: 636 hours			
Fuel	1,373.76	2.16	
Oil	69.96	0.11	
Repairs - Material	19.08	0.03	
Shop Expense	6.36	0.01	
Operation	508.80	0.80	
Depreciation	795.00	1.25	0.036

MINING COMPANY C
Operating Expense
1938
(Season of 98 days)

	Total Season	Per Hour	Per Cu. Yd. (76,111 Cu. Yds.)
General (Wash Plant, etc.)			
Labor	$1,865.34		
Supervision	998.00		
	2,863.34		$0.038
Mess			
Contracted for season at $2.08/man/day. Season 98 days for 12 men Cost/man/meal - $0.694	2,446.08		0.032
Total			$0.322

Cubic Yards Sluiced	36,111
Cubic Yards Stripped	40,000
Total Yards Moved	76,111

Operating Expense/cubic yard moved	$0.322
Operating Expense/cubic yard sluiced	$0.68
Total Expense/cubic yard moved	$0.346
Total Expense/cubic yard sluiced	$0.729
Cubic Yards Moved/20 hours	776
Cubic Yards Sluiced/20 hours	369

MINING COMPANY C
Statement of Expense
1938

Operating Expense		
Fuel	$3,524.28	
Oil	374.92	
Grease	81.27	
Repairs - Material	7,302.48	
Shop Expense	1,069.36	
Operation - Labor	6,253.14	
Depreciation	3,466.60	
Mess Expense	2,446.08	$24,518.13
Other Expenses		
Depletion	1,083.33	
Miscellaneous Operating Expense	582.50	
Miscellaneous Operating Material	139.20	1,805.03
Total Expense		$26,323.16

MINING COMPANY C
Operating Expense
1939
(Season of 141 days)

	Total Season	Per Hour	Per Cu. Yd. (151,000 Cu. Yds.)
Tractor No. 1 -- Factor: 728 hours			
Fuel	$ 327.60	$0.45	
Oil	65.52	0.09	
Grease	14.56	0.02	
Repairs -- Material	2,082.08	2.86	
Shop Expense	713.44	0.98	
Operation	728.00	1.00	
Depreciation	728.00	1.00	
	4,659.20	6.40	
Tractor No. 2 -- Factor: 2,430 hours			
Fuel	2,600.10	1.07	
Oil	145.80	0.06	
Grease	72.90	0.03	
Repairs -- Material	4,884.30	2.01	
Shop Expense	364.50	0.15	
Operation	2,430.00	1.00	Total two tractors:
Depreciation	2,065.50	0.85	
	12,563.10	5.17	$0.112
Dragline -- Factor: 2,230 hours			
Fuel	1,761.70	0.79	
Oil	312.20	0.14	
Grease	22.30	0.01	
Repairs -- Material	5,084.40	2.28	
Shop Expense	468.30	0.21	
Operation	2,230.00	1.00	
Depreciation	2,007.00	0.90	
	11,885.90	5.33	0.079
Pump -- Factor: 1,543 hours			
Fuel	3,178.58	2.06	
Oil	216.02	0.14	
Repairs -- Material	555.48	0.36	
Shop Expense	293.17	0.19	
Operation	1,234.40	0.80	
Depreciation	1,018.38	0.66	
	6,496.03	4.21	0.042

MINING COMPANY C
Operating Expense
1939
(Season of 141 days)

	Total Season	Per Hour	Per Cu. Yd. (151,000 Cu. Yds.)
General (Wash Plant, etc.)			
Supervision	$1,410.00		
Labor	5,640.00		
	7,050.00		$0.047
Mess (Season of 141 days)			
Supplies	5,207.07		
Labor	896.00		
Fuel	32.60		
Depreciation	50.00		
	6,185.67		0.041
Mess cost/man/meal = $0.72			
Total			$0.321

Cubic Yards Stripped	65,000
Cubic Yards Sluiced	86,000
Total Yards Moved	151,000

Operating Expense/cubic yard moved	$0.323
Operating Expense/cubic yard sluiced	$0.578
Total Expense/cubic yard moved	$0.343
Total Expense/cubic yard sluiced	$0.602
Cubic Yards Moved/20 hours	1,070
Cubic Yards Sluiced/20 hours	619

MINING COMPANY C
Statement of Expense
1939

Operating Expense		
Fuel	$ 7,867.98	
Oil	739.54	
Grease	109.76	
Repairs -- Materials	12,606.26	
Shop Expense	1,839.41	
Operation - Labor	13,672.40	
Depreciation	5,818.88	
Mess Expense	6,185.67	$48,839.90
Other Expenses		
Depletion	2,580.00	
Miscellaneous Operating Material	132.40	
Miscellaneous Operating Expense	249.30	2,961.70
Total Expense		$51,801.60

Comparative Table I*

		Stripping & Sluicing (Total Cu. Yds. Moved)			Sluicing Only			Mess	
		No. Cu. Yds.	Cu.Yds./ 20 Hrs.	Tot.Exp./ Cu. Yd. (dollars)	No. Cu.Yds.	Cu.Yds./ 20 Hrs.	Tot.Exp./ Cu.Yd.	Cost Cu.Yd. Total	Cost/ Man/ Meal
Company A	1938	12,222	84.3	1.163	12,222	84.3	1.163	0.147	0.59
	1939	15,470	104.5	0.966	15,470	104.5	0.966	0.128	0.64
Company B	1938	209,512	1,408.0	0.490	139,821	1,195	0.74	0.022	0.72
	1939	265,962	1,915	0.420	112,517	1,195	0.99	0.017	0.73
Company C	1938	76,111	776	0.346	36,111	369	0.729	0.032	0.694
	1939	151,000	1,070	0.343	86,000	619	0.602	0.041	0.72

*All costs are total expense.

Comparative Table II

Operating Expense/Cu. Yd. for Various Units

		Total Cu. Yds. Moved		Sluicing	
		Tractor	Dragline	Pumping	Wash Plant
Company A	1938	0.434		0.072	0.403
	1939	0.362		0.051	0.325
Company B	1938	0.170	0.043	0.089	0.045
	1939	0.141	0.037	0.096	0.060
Company C	1938	0.133	0.083	0.077	0.080
	1939	0.112	0.079	0.076	0.082

Water Duty

No calculation has been made of the duty of water used in the operation of these three mining companies. The reason for this is that there are so many influencing factors to be taken into consideration that it would be almost impossible to obtain a figure that would be applicable.

Capacities vary over wide limits mainly because of the fine material which is still held in suspension after the water has passed through the settling pond and entered the pump. This material not only adds to the specific gravity of the water but results in a loss of efficiency through increased clearances which are caused by excessive wear on the impeller. The power unit for the pump runs at a governed speed and with any increase in the pump clearances less water will be delivered to the washing plant. Thus, after a few hours, or a few days, the pump will not deliver its rated load. As no measurements of the water were taken at the washing plant it is not known just how fast this wear takes place, but it is much faster than some operators realize. Twice during the season of 1939 it was necessary to build up the impeller of the large pump at Company B.

At the mine of Company A, the water from the pump was supplemented with water from the neighboring creeks; but since some of them flow only when it rains, the amount of water available for mining fluctuates accordingly.

Companies B and C have another factor which enters into a calculation of this kind: that is, the dragline may not be running at ful capacity at all times. The amount of gravel available for the dragline varies greatly with its compacted condition and the number of boulders, as well as the distance through which the tractor has to push it.

These are only the more obvious factors. They could be analyzed by systematic study but there was not sufficient time to do justice to that part of the problem.

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