LLOYD MINE
ANNUAL REPORT
YEAR 1948

8. COST OF OPERATING (Cont.)

b. Detailed Cost Comparison (Cont.)

	1948		1947	
	Amount	Per Ton	Amount	Per Ton
41. General Supplies	8,650.89	.088	10,001.32	.039
42. Iron & Steel	2,687.20	.027	2,604.90	.010
43. Oil & Grease	1,025.80	.010	1,378.60	.005
44. Machinery Supplies	8,313.43	.085	9,355.11	.037
45. Explosives	12,112.06	.123	11,336.87	.045
46. Lumber & Timber	12,129.53	.123	15,457.74	.061
47. Fuel	4,589.11	.047	3,152.30	.012
48. Electric Power	26,672.54	.272	36,439.37	.144
49. Sundries	10,429.60	.106	11,318.09	.045
Total Supplies	86,610.16	.881	101,044.30	.398

An explanation of the variation in cost in each account is omitted because of the difference in the nature of the operations in 1948 and 1947. In 1947 the mine was on a normal production basis throughout the year while in 1948 operations were concentrated chiefly on development work. In the first half of 1948 the small reserves above the 8th Level were depleted after which the underground program was confined entirely on development until late in the year when the mine began to reach a production basis again from the 9th Level. The small production that could be realized during the period the last scram operations were conducted above the 8th Level and also while work was confined entirely to ore development above the 9th Level accounts for the high mining cost in 1948. Explanations of the following cost accounts are given because of their significance.

1. Exploring in Mine

There was a smaller expenditure in this account due to considerably less footage drilled. One relatively short hole was drilled from the winze plat on the 9th Level.

4. Development in Ore

The large expenditure in this account is due to charging all the ore development above the 9th Level to operating. In the third quarter of the year nearly all the contracts were employed on ore development and production during this period was mostly from this source.

5. Stoping

The total expenditure in this account is less due to the small mining program that was conducted. The small product, however, accounts for the higher cost per ton.

LLOYD MINE
ANNUAL REPORT
YEAR 1948

8. COST OF OPERATING (Cont.)

b. Detailed Cost Comparison (Cont.)

5. Stoping (Cont.)

	1948		1947	
	Amount	Per Ton	Amount	Per Ton
General Supplies	925.17	.009	4,547.81	.018
Iron & Steel	1,312.69	.013	1,303.71	.005
Oil & Grease	92.39	.001	218.58	.001
Machinery Supplies	1,890.37	.019	1,181.93	.005
Explosives	6,082.43	.062	9,245.20	.037
Timber & Lumber	21.81	.000	66.38	.000
Electric Power	3,619.14	.038	4,811.83	.019
Sundries	383.89	.004	1,463.43	.005
Expense Accounts	761.86	.008	959.19	.004
Total Supplies	15,089.75	.154	23,798.06	.094
Payroll Labor	39,773.81	.405	98,817.15	.389
Gen. Storehouse & Gen. Shops Labor	433.72	.004	701.13	.003
Shops, Labor, etc.	3,573.48	.036	7,310.21	.028
Total Labor	43,781.01	.445	106,828.49	.420
Grand Total	58,870.76	.599	130,626.55	.514
Production Tons Stoped	70,836		238,901	
Average Miners Rate Stoping	13.25		13.54	
Average Tons Per Man Stoping	26.25		40.86	

7. Tramming

Development of the 9th Level by means of the winze will result in a higher tramming cost due to the additional labor needed in transferring cars between the 9th and 8th Levels.

9. Pumping

The pumping expense was smaller due to the decrease in mine water. About 47% of the underground water was diverted to the Morris Mine and the charges by the Inland Steel Company for pumping this water decreased due to a smaller proportion of Lloyd water to the total volume.

	Total Inland Steel Co.			C.C.I. Co. Proportion		
Year	Amount	Avg. Gals. Per Min.	Percent	Amount	Avg. Gals. Per Min.	Percent
1948	84,077.89	1082.9	93.04	5,855.38	80.2	6.96
1947	65,474.05	966.8	90.0	7,482.69	109.2	10.0
1946	43,090.37	887.4	91.4	5,600.69	83.5	8.6
1945	43,150.99	857.6	89.9	6,518.28	96.8	10.1
1944	59,011.80	887.9	91.6	5,393.50	83.1	8.4

LLOYD MINE
ANNUAL REPORT
YEAR 1948

8. COST OF OPERATING (Cont.)

b. Detailed Cost Comparison (Cont.)

9. Pumping (Cont.)

The following table shows a distribution of the total Lloyd Mine water pumped:

	Average Gallons Per Minute	
	1948	1947
Second Level Water Supply	24.1	25.1
Fifth Level Water Supply	66.8	106.6
Seventh Level to Morris Mine	80.2	109.2
Total	171.1	240.9

The peak volume in mine water was reached in May when an average of 263.1 G.P.M. was pumped following the effects of the spring run-off. The decrease in mine water is due to the lighter spring run-off and rainfall compared with the previous year.

12. Underground Superintendence

There has been no change in the size of the supervisory force but a substantial salary increase was granted these employees effective August 1. In addition a Christmas bonus of $100.00 was given each salaried supervisor.

18. Hoisting

Development of the 9th Level by means of the winze also results in a higher hoisting cost due to operation and maintenance of the auxiliary hoist.

28. - 41. Inclusive

The total expense in direct charges was less due to the smaller size operation compared with the previous year. The cost per ton was higher in every account due to the small production. The increase in wages and salaries is also reflected in the higher cost. Employees' vacation expense was less due to the smaller labor force.

9. EXPLORATION AND FUTURE EXPLORATIONS

There was very little exploration done and it consisted of drilling one hole from the west end of the winze plat on the 9th Level. The hole was drilled to explore a structure that was developed by drilling several years ago from the 7th and 8th Levels. A small tonnage was proven in this structure on the upper levels but the fact that the hole drilled from the 9th Level failed to find ore proved there is insufficient tonnage to warrant development or further exploration in this area.

LLOYD MINE
ANNUAL REPORT
YEAR 1948

9. EXPLORATION AND FUTURE EXPLORATIONS (Cont.)

It is planned to drill at least one more hole from the 8th Level to explore another structure to the south of the main deposit. Some mining and drilling was done in this deposit on the 6th Level and there is a possible chance that enough tonnage can be proven between the 6th and 8th Level to warrant development for mining. On the basis of all the drilling that has been done in the search for new ore it appears that the possibilities have been exhausted for an important new find above any of the present levels.

A characteristic of some of the structures is worthy of note in that the dikes and slates are nearly vertical in dip suggesting deep structures that may have concentration at depths not yet reached by drilling. A study of exploring this possibility is being made by the geological department.

The following table shows the cost of the diamond drilling that was done:

Feet	Cost Per Foot	Total
592'	5.41	$ 3,202.95

The following is a log of the drilling:

D. D. H. No. 179
9th Level-Dip ∠ 11° - 30' S 45° W

Depth	Material
0' - 529'	Slate
529' - 559'	Diabase Dike
559' - 592'	Slate (Stopped)

10. TAXES

The following shows a comparison of the taxes paid in 1948 and 1947 in Ishpeming Township:

Lloyd & Section 6	1948 Valuation	1948 Taxes	1947 Valuation	1947 Taxes
SW¼ of NW¼ Sec 6, 47-27, 40 Acres) N½ of SW¼ Sec 6, 47-27, 81.67 ") N½ of SE¼ Sec 6, 47-27, 80 ")	230,000	4,900.63	135,000	2,168.18
Personal, Ore in Stock, Supplies and Equipment	300,000	6,392.13	605,000	9,716.36
Total by State Tax Commission	530,000	11,292.76	740,000	11,884.54
Collection Fees		112.93		118.84
Total Taxes		11,405.69		12,003.38

LLOYD MINE
ANNUAL REPORT
YEAR 1948

10. TAXES (Cont.)

C.C.I. Co. Misc. Lands	1948 Valuation	1948 Taxes	1947 Valuation	1947 Taxes
S½ of NE¼ Sec 6, 47-27, 80 Acres	320	6.82	320	5.14
SE¼ of NW¼ Sec 6, 47-27, except R of W	350	7.46	350	5.62
S½ of SW¼ Sec 6, 47-27, except R of W	700	14.91	700	11.24
SW¼ of SE¼ Sec 6, 47-27, except R of W	350	7.46	350	5.62
SE¼ of SE¼ Sec 6, 47-27, except R of W	575	12.25	575	9.24
Total	2,295	48.90	2,295	36.86
Collection Fees		.49		.37
Total C.C.I. Co. Misc. Lands		49.39		37.23
Total Lloyd Mine	532,295	11,455.08	742,295	12,040.61
West Ishpeming				
Lot 4, Blk 2 & Lots 19 & 20, Blk 9	50	1.08	300	4.87
North Lake				
Houses on Sec 6, 47-27	4,000	86.08	4,000	64.88
Total Ishpeming Township	536,345	11,542.24	746,595	12,110.36
Rate		2.13071		1.606

The decrease in taxes is due to the smaller valuation on personal property. The valuation on reserves was increased because of the larger tonnage but this increase was more than offset by the smaller personal property valuation. The tax rate was raised nearly 33% due entirely to the large increase in the Township school tax.

	1948	1947	1946	1945	1944
Taxes Per Ton Produced	.117	.048	.056	.056	.052
Taxes Per Ton Shipped	.070	.029	.069	.054	.070

11. ACCIDENTS AND PERSONAL INJURY

The accident frequency rate was lower than last year but the severity rate was worse. There were five compensable accidents, four less than in the previous year although one of the accidents in 1948 was quite serious in nature. Due to a smaller average number of men employed throughout the year the total man days worked dropped from 40,520 in 1947 to 33,687 in 1948. The man days lost on account of all accidents was 3,213 and for compensable accidents only there was a total of 3,193 man days lost. The high loss in man days is due to a time charge of 3,000 days in the case of an accident which necessitated a leg amputation at the knee. The following table shows a comparison of the severity and frequency rates:

Year	Frequency Rate	Severity Rate
1948	44.53	11.922
1947	74.05	1.228

Frequency Rate - Number of accidents per 1,000,000 man hours.
Severity Rate - Number of days lost per 1,000 man hours.

LLOYD MINE
ANNUAL REPORT
YEAR 1948

11. ACCIDENTS AND PERSONAL INJURY (Cont.)

The compensable accidents are listed in detail as follows:

Accident No. 881, May 18, 1948, Felix Juhola, Company Account Miner. He was dumping a tram car into the pocket at the shaft and while pulling the box back to an upright position his finger got squeezed between the catch and the frame of the car - fracture of middle finger, right hand - time lost - 36 days.

Accident No. 882, May 19, 1948, Alderic Villeneuve, Company Account Miner. While he was pulling the box of the car back to an upright position after dumping it into the pocket his finger got squeezed between the catch and the frame of the car - contusion and laceration of third finger, right hand - time lost - 45 days.

Accident No. 883, July 17, 1948, Elias Pennala, Sub Boss. He pulled a loaded tram car off the winze cage with an air hoist which had a steel cable and a hook on one end that was attached to the car. As the car was passing by him he attempted to take the hook off the car and missed it and then stepped out from behind the hoist and made a second try. In doing so he stepped over the cable that was still attached to the car with one leg and as the car moved down the track the cable was drawn tight squeezing his left leg between the cable and a timber leg - severe contusion of left leg necessitating amputation at the knee - time charged - 3,000 days.

Accident No. 884, October 15, 1948, Vincenzo Elvitici, Surface Laborer. While he was carrying a piece of cribbing timber he stepped on a small block of wood causing a twist in his left ankle - partial fracture of left ankle - time lost - 40 days.

Accident No. 885, December 6, 1948, Thomas Honkala, Company Account Miner. He was loading powder into a bucket at the bottom of the No. 910B Raise in preparation to hoisting it to a sub level. While he was placing the powder in the bucket a small chunk dropped down the raise striking him on the left shoulder and side - fracture of left clavical and three ribs left side - time lost to the end of the year - 24 days.

12. NEW CONSTRUCTION AND PROPOSED NEW CONSTRUCTION

There was very little new construction on surface and the usual erection of wood trestle at the close of the shipping season comprised most of the work. A total of 39 bents were erected for stocking both Silica and Lloyddale grades in the area to the east of the shaft.

LLOYD MINE
ANNUAL REPORT
YEAR 1948

12. NEW CONSTRUCTION AND PROPOSED NEW CONSTRUCTION (Cont.)

At the west end of the timber yard a new coal storage bin was constructed on the north side of the fill for the track that leads to the timber yard. A portion of the fill was excavated to enable construction of the bin directly adjacent to the track on the north side. Old discarded trestle stringers were used to form the walls and also to construct a small pocket and chute directly under the track for unloading the cars. A roof was also constructed over the bin to completely enclose it. Stoker coal that was formerly stored in an open bin caused considerable trouble at times to operation of the stokers due to its high moisture content either from rainfall or snow.

New construction underground consisted of erecting a fan station and installing another fan in the ventilation system on the 8th Level. The fan was installed in the rock drift leading to the ventilation raise between the 9th and 8th Levels. After stripping a section of the drift to provide sufficient width concrete brattices with doorways were constructed to form two walls of the structure that houses the fan. A breeching that is connected to the discharge of the fan was made with a door arrangement that permits the direction of the ventilating current to be reversed quickly. Construction of the fan station was completed and the fan was put into operation early in 1949.

13. EQUIPMENT AND PROPOSED EQUIPMENT

There was a substantial amount of new equipment needed in view of the increase in the operating life of the mine upon development of the 9th Level. Many of the scraper hoists and drill machines are either worn out or are obsolete so it became necessary to replace some of these with new or more modern equipment. Most of the new equipment was purchased under E & A cc-159.

In addition to the new equipment six used 65 Cu. Ft. rocker dump cars were purchased from the Negaunee Mine to provide another train of cars for the underground tram. Due to operating the 9th Level by means of the winze additional cars were needed for a more efficient tramming operation. The following are the larger items of new equipment added to the inventory in 1948:

Item	Number	Cost
Scraper Hoist - I.R.-25MM3C	4	$ 10,684.00*
Utility Hoist - I.R.-HU6	2	1,254.00*
Fan Motor - Westinghouse 25 h.p.	1	646.00*
Motor Pump - I.R.-2RVH-20	1	522.65*
International Truck - KBS5-1½Ton	1	2,647.76**
Drill Machine - I.R.-RB-12	4	1,140.00
Drill Machine - I.R.-R-48	1	500.00
Bicycle Sheave - 5' Dia.	3	1,438.42*
Rocker Dump Car - 65 Cu. Ft.	6	600.00

* Items charged to E & A cc-159
** Items charged to E & A cc-250

LLOYD MINE
ANNUAL REPORT
YEAR 1948

14. MAINTENANCE AND REPAIRS

a. Mine

There were no serious breakdowns of equipment during the year although the general maintenance cost in some cases was higher than last year. The upkeep on the surface buildings was low because very little repairs were required to maintain them in good condition. There have been no repairs or remodeling done to the combined office, dry house and shop building excepting some interior painting that was done in the office rooms. The wood trim and window sash and doors on the engine house were painted and the roof was given another coat of asphalt to prolong its life. There were no repairs made to the other surface buildings. Repair work in the shaft house has consisted almost entirely of replacing worn out plate in the chutes below the skip dump and also in the chutes and storage pockets below the top landing. Most of the equipment in the engine house has required only the usual maintenance to keep it in good running order. The Sullivan Compressor developed a bad knock making it necessary to overhaul the unit to put it into good operating condition again. The small Ingersoll Rand Compressor has seen very little service during the year because the reduced size of the underground operation does not require running both units to supply the needs of the mine.

Some major repairs were made in the shaft during the vacation period in August. A number of badly worn and rotted dividers between the skip roads were replaced with new 8" x 12" fir members and new casing plank was installed in a section where the old plank was rotted. Shaft inspections have been continued on weekends and in the middle of the week, but the repair work that has been required following the inspections has not been large. Several lengths of worn out runners were replaced near the skip dump and also near the loading pocket on the 8th Level.

During the first several months of the year a timber repair program was required in a section of the 8th Level haulage drift in ore. Heavy crushing was experienced due to mining approaching the level elevation and constant repair work was required for a while in sections of the drift to maintain it open for the last scram operations. When mining was completed no further repair work was done in this drift and during the balance of the year timber repair work was at a minimum. Only a small amount of the 9th Level drifts have required timber support and consequently very little main level repair work is anticipated during the period operations will be conducted from this level. There was no repair work required in raises because mining was practically completed above the 8th Level at the beginning of the year and most of the mining that was done near this elevation was conducted directly from the level. On the 9th Level, raises were put up into new areas late in the year and had not been in service long enough to require any repairs.

LLOYD MINE
ANNUAL REPORT
YEAR 1948

14. MAINTENANCE AND REPAIRS (Cont.)

a. Mine (Cont.)

A large amount of maintenance was required on the auxiliary hoist at the winze before it was operating satisfactorily. This hoist originally came from the Wade Mine and had not been in service for many years and some parts had been salvaged for use on other hoisting equipment or were in too poor condition to give dependable service. Many new parts were made at the general shops and this included new brake bands, brake stand bearings and indicator. As mentioned previously the slow speed of the hoist was a factor limiting production and consequently it was speeded up by making a change in the gearing.

Other underground equipment that required a substantial amount of repairs was the tramming equipment. To obtain the best efficiency in transferring cars between the 8th and 9th Levels it is important that all the tram cars be maintained in the best condition. To achieve this it became necessary to overhaul many of the cars, replacing worn dumping catches and reconditioning or installing new couplings. Repairs to locomotives has consisted chiefly of replacing armature and worn out wheel assemblies on occasions. A number of the scraper hoists excluding the new units that were purchased in 1948 are the 15 h.p. size and are only used where the scraping distance is relatively short. These hoists are becoming obsolete and are used chiefly as emergency spares and major repairs on them are not warranted. Some worn out power drills were discarded and replaced with new machines.

b. Location

1. General Maintenance

The cost of the location maintenance was much less than last year and this is due to the absence of major repairs and extensions to the water supply system. Operation and maintenance of the water system has always been the largest item of expense because a portion of the underground pumping cost is charged to this account. On April 1 the Ishpeming Township took over the water system in the location and later in the year a project was completed connecting this system with the City of Ishpeming water supply. Acquisition of the North Lake water system by the Township is welcome because the operation and maintenance cost to the mine has always been higher than the income that was derived from this service.

Before the location water system was turned over to the Township repairs were made to water mains on two occasions when leaks broke out and during the winter it was necessary several times to thaw frozen lines.

	Labor	Supplies	Total
Water	-	2,809.03	2,809.03
Water Mains	246.73	39.35	286.08
Fire Protection	2.67	.12	2.79
Fencing	88.85	.68	89.53
Total	338.25	2,849.18	3,187.43

LLOYD MINE
ANNUAL REPORT
YEAR 1948

14. MAINTENANCE AND REPAIRS (Cont.)

b. Location (Cont.)

1. General Maintenance (Cont.)

The following table shows a comparison of the location maintenance expense for the past five years:

Year	Amount
1948	3,187.43
1947	5,524.52
1946	4,854.44
1945	3,464.61
1944	4,358.71

2. Rented Buildings

Maintenance expense on buildings was less due to the absence of major repairs and improvements. There are only two rented buildings and these are the store and the superintendent's house. The roof on the store building was given a coat of asphalt to seal some small leaks and prolong its life. Repairs to the front of this building have been postponed but in the coming year it will be necessary to replace the rotted timber sills under the display windows and make some other general repairs to put it into good condition. The following is a comparison of the expenditure on rented buildings in the past five years:

Year	Amount
1948	455.91
1947	581.23
1946	92.22
1945	403.95
1944	3,290.52

The club house has remained closed and there has been no maintenance expense on this building. Since the building was closed in July, 1946 the windows have been boarded up and the building has not been used for any purpose except one basement room which has continued to be let for use by a local men's club which provide their own heat and lighting.

15. POWER

There was less power consumed due to the smaller underground operation compared to last year. There was one delay of short duration to operations due to lack of electric power when the main cable outside the engine house blew out. A general shortage of electric power produced by the Cliffs Power and Light Company has made it necessary to revise pumping and working schedules late in the year as power conservation measures. These, however, in no way have delayed operations. On Saturday, September 4, the mine was idle due to a general power shortage caused by major repairs to one of the Cliffs Power and Light Company's generating plants. The following is a five year comparison of the power cost:

LLOYD MINE
ANNUAL REPORT
YEAR 1948

15. POWER (Cont.)

Year	K.W.H.	Cost	Rate
1948	1,994,400	31,640.64	.01586
1947	2,335,200	36,760.08	.0158
1946	2,011,200	29,830.08	.0148
1945	2,937,800	43,337.04	.0148
1944	3,090,000	44,655.12	.0145

16. WATER SUPPLY

The water supply has continued to be obtained from the 2nd Level and the Morris No. 8 Well. There has been a gradual decrease in the volume of water on the 2nd Level making it necessary to draw more heavily from the surface well. The chlorinators at both sources of supply have required only minor repairs to maintain them in good working condition.

Late in the year after completing installation of the water main between the City of Ishpeming and North Lake more water was drawn from the surface well and diverted into the Ishpeming water system. Unusually light rainfall together with a constantly increasing demand for water has lowered the water level in all the reservoirs in this area and as this condition became more acute diversion of water from the Morris well to the City of Ishpeming became necessary to augment the supply. There is every indication that this diversion of water must be continued until the spring of 1949 when the spring run off and rainfall, it is hoped, will restore the water level in the reservoirs.

After normal water levels have been restored in the reservoirs the water supply in the location will be obtained from the City of Ishpeming and the water supply for the mine will continue to be obtained from the underground source and the surface well if needed.

17. CONDITION OF PREMISES

There has been no landscaping done on the premises for many years but the grounds have been kept in neat condition by routine cleaning. Existing shrubbery and trees around the lawn and flower garden have been maintained in attractive appearance during the summer months.

18. NATIONALITY OF EMPLOYEES

	American Born	Foreign Born	Total	Percent
Finnish	42	13	55	40.1
Italian	8	19	27	19.7
French	25	-	25	18.2
English	14	1	15	10.9
Swedish	11	1	12	8.8
Austrian	1	1	2	1.5
Norwegian	1	-	1	.8
	102	35	137	100.0

MATHER MINE "A" SHAFT
ANNUAL REPORT
YEAR 1948

1. GENERAL:

Operations during the eighth year since the beginning of shaft sinking resulted in the first annual production in excess of 1,000,000 tons, although shipments were limited to 990,757 tons. There was every indication that production could be substantially increased during 1949.

The only operating delay of any consequence was due to a bearing failure in the engine house and occasioned the loss of approximately 11,000 tons.

Labor relations continued to be completely satisfactory, with an overabundance of man power, although it was necessary to train and rapidly advance young men of ability and ambition. There were no formal grievances during the year, and membership in the union continued at 70% as contrasted with 85% to 90% prior to the strike.

Pocket and stockpile shipments were started as soon as the opening of navigation permitted, and continued throughout the entire shipping season. The only ore remaining at the end of the shipping season was the small amount which was too wet to be loaded.

The 5th Level was again the major producer throughout the year, with the 2nd Level retaining second place. The 6th Level showed a substantial increase and hopes for increased production in 1949 are dependent on this new level.

By the end of the year, development work preparatory to making the 7th Level available for mining was well under way. There is no doubt that continuing to increase the volume of production depends on making this new level available as rapidly as possible.

MATHER MINE "A" SHAFT
ANNUAL REPORT
YEAR 1948

2. PRODUCTION, SHIPMENTS & INVENTORIES:

a. Production by Grades:

	1948				1947
	Product	Transfers	Stockpile Overrun	Total	Total
Mather	308,035	316	7,457	315,176	464,385
Mather Special	268,043	56,677	6,256	330,976	265,284
Mather Mine Run	407,492	56,361	3,718	354,849	-
Total	983,570	0	17,431	1,001,001	729,669
Rock				116,655	94,501

The production of Mine Run grade was started as an experiment on the 15th of August, with very small amounts of relatively high sulphur material being graded out and shipped as Special. The success of this experiment warranted the continuation throughout the balance of the year. The above table shows the Mather ore which was produced as such prior to starting the production of Mine Run. The tonnage shown as Mather Special includes all of that grade produced prior to the Mine Run and, in addition, the extremely high sulphur material which was graded out of the Mine Run grade. Actually, all of the Mine Run material was handled as Mather grade by the Shipping Department, with results as shown below. Throughout the balance of this report, the Mather includes all of the Mine Run.

	1948				1947
	Product	Transfers	Stockpile Overrun	Total	Total
Mather	715,527	56,677	11,175	670,025	464,385
Mather Special	268,043	56,677	6,256	330,976	265,284
Total	983,570	0	17,431	1,001,001	729,669
Rock				116,655	94,501

b. Shipments:

	Pocket Tons	Stockpile Tons	Total Tons	Total 1947	Increase
Mather	444,031	173,100	617,131	474,741	142,390
Mather Special	195,690	177,936	373,626	235,534	138,092
Total	639,721	351,036	990,757	710,275	280,482

MATHER MINE "A" SHAFT
ANNUAL REPORT
YEAR 1948

2. PRODUCTION, SHIPMENTS & INVENTORIES: (Continued)

c. Stockpile Inventories:

	1948		1947	
Mather	100,487	Tons	47,593	Tons
Mather Special	-	"	42,650	"
Total	100,487	"	90,243	"

d. Division of Product by Levels:

	Mather	Mather Special	Total Tons
Second (1600') Level	221,193	23,354	244,547
Third (1750') Level	30,354	22,405	52,759
Fifth (2050') Level	278,766	222,123	500,889
Sixth (2200') Level	185,214	161	185,375
	715,527	268,043	983,570
Transfers	56,677	56,677	0
Stockpile Overrun	11,175	6,256	17,431
Total	670,025	330,976	1,001,001

e. Production by Months:*

Months	Mather	Mather Special	Total	Rock
January	33,564	30,731	64,295	9,020
February	27,416	42,057	69,473	8,745
March	43,534	43,012	86,546	9,680
April	37,547	49,841	87,388	9,944
May	36,893	32,490	69,383	13,651
June	49,361	34,218	83,579	13,376
July	58,682	28,599	87,281	8,371
August	58,586	12,290	70,876	7,502
September	84,786	12,688	97,474	9,328
October	68,516	29,229	97,745	8,921
November	67,138	9,565	76,703	8,547
December	92,827	-	92,827	9,570
Total	658,850	324,720	983,570	116,655
Current Year Stockpile Overrun	11,175	6,256	17,431	
	670,025	330,976	1,001,001	

* Including Net Transfers: Mather -56,677; Mather Special +56,677

MATHER MINE "A" SHAFT
ANNUAL REPORT
YEAR 1948

2. PRODUCTION, SHIPMENTS & INVENTORIES: (Continued)

f. Ore Statement:

	Mather	Mather Special	Total	Total Last Year
On Hand January 1, 1948	47,593	42,650	90,243	70,849
Output for Year	715,527	268,043	983,570	717,618
Transfers	56,677	56,677	-	-
Overrun	11,175	6,256	17,431	12,051
Total	717,618	373,626	1,091,244	800,518
Shipments	617,131	373,626	990,757	710,275
Balance on Hand	100,487	-	100,487	90,243
Increase in Output	263,404	2,548	265,952	382,986
Increase in Ore on Hand			10,244	19,394

Working Schedule:

1948 - 2-8 hr. shifts*, 6 days per week, Jan. 1st to Dec. 31, 1948.

* Main level development 3-8 hr. shifts, 6 days per week.

The operation was increased during the year by the addition of a number of mining and development crews on the third shift. By the end of the year, this had developed into practically a three shift operation.

1947 - 2-8 hr. shifts*, 6 days per week, Jan. 1st to Feb. 18, 1947.
Idle account of water trouble, Feb. 19th to 26th, 1947.
2-8 hr. shifts*, 6 days per week, Feb. 27th to Dec. 31, 1947.

* Main level development 3-8 hr. shifts, 6 days per week.

1946 - 2-8 hr. shifts*, 6 days per week, Jan. 1st to Feb. 7, 1946.
Idle account of strike, Feb. 8th to May 21, 1946.
2-8 hr. shifts*, 6 days per week, May 22nd to Dec. 31, 1946.

* Main level development 3-8 hr. shifts, 6 days per week.

1945 - 3-8 hr. shifts, 5 days per week, Jan. 1st to 3rd, 1945.
2-8 hr. shifts, 5 days per week, Jan. 4th to 19th, 1945.
2-8 hr. shifts, 6 days per week, Jan. 22nd to Dec. 31, 1945.

1944 - 3-8 hr. shifts, 5-1/3 days per week, Jan. 1st to July 31, 1944.
3-8 hr. shifts, 5 days per week, Aug. 1st to Dec. 31, 1944.

1943 - 3-8 hr. shifts, 5-2/3 days per week, Jan. 1st to 31st, 1943.
3-8 hr. shifts, 5-1/3 days per week, Feb. 1st to Dec. 31, 1943.

MATHER MINE "A" SHAFT
ANNUAL REPORT
YEAR 1948

2. PRODUCTION, SHIPMENTS & INVENTORIES: (Continued)

g. Operating Delays:

There were two major operating delays, both caused by the failure of one of the large bearings in the skip hoist motor generator set. The total lost time aggregated practically three operating days, with an estimated loss of 11,100 tons. The first failure occurred prior to the midnight shift on July 5th, and the second on August 1st prior to the midnight shift. The bearing was repaired in the emergency repair shop of the General Electric Company in Milwaukee on the first occasion, and by the local mechanical crew on the second.

There was also a considerable amount of general delay due to the shortage of hydro-electric power and frequent periods of low voltage. This power shortage was partially counteracted by changes in the working schedules throughout the numerous properties on the Range. A substantial saving in power was accomplished by rescheduling several mines at a time and throwing the heaviest operating loads onto the midnight shift. At this property, the rescheduling was done twice during the year, once from the 29th of February to the 28th of March, and the second time from the 31st of October until the 12th of December.

3. ANALYSIS:

a. Average Mine Analysis on Output (Dried):

Grade	Iron	Phos.	Silica	Sulphur
Mather	58.72	.106	9.18	.100
Mather Special	58.22	.106	8.84	.283

b. Average Analysis on Straight Cargoes:

All of the shipments during 1948 were in mixed cargoes.

c. High Sulphur Ore:

The problem of high sulphur ore decreased considerably throughout the year to the point where all of the product was produced as a mine run "Mather" grade starting on the 15th of August. This production, averaged in with the tonnage produced prior to that date, resulted in the above averages. In general, no new high sulphur areas were developed and, in addition, there was a large increase in the production from the territories where the sulphur is relatively low. Increased production from the 6th Level should tend to keep the average of the new Mather grade below .150%.

d. Complete Analysis of Ores in Stock: (Dried)

	Iron	Phos.	Silica	Mang.	Alum.	Lime	Mag.	Sulph.	Loss	Moist.
Mather	58.50	.106	9.50	.33	2.82	.67	.60	.165	2.02	11.70

The continuing increase in the production from the low sulphur 6th Level area should result in a substantial lowering of the above sulphur figure throughout the coming year.

MATHER MINE "A" SHAFT
ANNUAL REPORT
YEAR 1948

4. ESTIMATE AND ANALYSIS OF ORE RESERVES:

For purposes of comparison, the estimate of ore reserves as reported to the State Tax Commission again shows a division between Mather and Mather Special. The same general estimating plan was followed, in that the underground information was used to augment the original estimate made from the surface drill hole sections. Where the underground work extended far enough to include a portion of the reserves formerly estimated from surface drilling, the original estimate was reduced and the underground estimate increased in line with the new information.

Assumption: 12 cu. ft. equal one ton.
10% deduction for rock and loss in mining.

	Mather Standard	Mather Special	Total Underground	Diamond Drilling	Total Tons
Reserves Indicated By Surface Diamond Drilling.....	5,733,318			5,733,318	
Reserves Indicated By Underground Development:					
Above 2nd Level....	201,833	195,197	397,030		
Between 2nd & 3rd Levels.....	64,046	536,312	600,358		
Between 3rd & 5th Levels.....	1,473,061	999,674	2,472,735		
Between 5th & 6th Levels.....	3,404,200	117,396	3,521,596		
Below 6th Level....	861,040	21,250	882,290		
Total Gross As Of November 30, 1948..	6,004,180	1,869,829	7,874,009	5,733,318	13,607,327
Less December 1948 Production.....	92,827	-	92,827	-	92,827
Total Gross as of December 31, 1948..	5,911,353	1,869,829	7,781,182	5,733,318	13,514,500
Less 10% for Rock and Loss in Mining	600,418	186,983	787,401	573,332	1,360,733
Net Total as of December 31, 1948..	5,310,935	1,682,846	6,993,781	5,159,986	12,153,767

MATHER MINE "A" SHAFT
ANNUAL REPORT
YEAR 1948

4. ESTIMATE AND ANALYSIS OF ORE RESERVES: (Continued)

A comparison with last year's estimate indicates a gross gain, including the production for the year, of 1,926,253 tons as compared with 331,451 tons gain in 1947.

	Total Tons
Net Total December 31, 1948	12,153,767
Net Total December 31, 1947	11,228,515
Net Gain in Reserves	925,252
1948 Production	1,001,001
Gross Gain in Reserves	1,926,253

Expected Average Natural Analysis of Ore Reserves:

Grade	Total Tons	Iron	Phos.	Sil.	Mang.	Alum.	Lime	Mag.	Sulph.	Loss	Moist.
Mather by Surface Diamond Drilling..	5,159,986	53.15	.122	5.08	.25	2.62	.58	.60	.014	1.97	12.50
Mather by Undg. Development.....	6,993,781	52.50	.120	7.30	.20	2.45	1.00	.50	.125	2.25	11.50
	12,153,767										

MATHER MINE "A" SHAFT
ANNUAL REPORT
YEAR 1948

5. LABOR AND WAGES:

a. Comments:
The shortage of experienced underground labor continued throughout the entire year, although the supply of unskilled labor was completely adequate. Once again the turn-over was large due to the necessity for weeding out unsatisfactory men and due to the fact that a fairly large number of temporary workmen are included in the records. Transfers to "B" Shaft were few, as were transfers from the Negaunee Mine. However, the prospects are good for obtaining a substantial number of skilled, experienced men from that latter property early in 1949.

Of the new men added to the roll during the year, 13 were transfers from the Negaunee Mine, 32 were transfers from other mines and 167 were new employees, of which 100 had had no previous underground experience.

Number of Men 1/1/48.....	518	
Added to Roll During the year.....	212	
Total.....	730	
Separations.....	87	(6 to "B" Shaft)
Total on Payroll 12/31/48.....	643	
Net Gain.....	125	

The number of World War II veterans was 105 of the 212 added to the roll during the year, and 251 of the 643 on the payroll at the end of the year.

As is apparent from the above figures, the problems of supervision continued to be great. The necessity for training inexperienced men to mining jobs, and the rapid turn-over in the crew required the rapid advancement of men who showed aptitude and ability. Six new shift bosses were promoted to this position during the year, and one was transferred from the Negaunee Mine. Several of the older shift bosses were, in turn, promoted to the position of Mine Foreman, and two of the Mine Foremen were promoted to the new position of Assistant Captain.

MATHER MINE "A" SHAFT
ANNUAL REPORT
YEAR 1948

5. LABOR AND WAGES:
(Continued)

a. Comments:(Continued)
The very satisfactory labor relations which have always been enjoyed at this property were continued throughout the year. There were no formal grievances presented, in spite of the necessity for frequent disciplinary measures. One meeting was held with the union in an attempt to forestall the discharge of a union member. The request for leniency was denied and the man was discharged for just cause.

The contract with the C.I.O. was continued and, surprisingly enough, the percentage of union membership remained the same at 70% instead of increasing.

The two temporary changes in the working schedule due to the necessity for rearranging power loads have already been discussed, as well as the gradual increase to practically a third shift of development, mining and hoisting. There was a graduated increase in wages effective July 16th from 9½¢ to 16¢ per hour, with the contract continued to April 1950, but including a reopening provision on or before May 17, 1949 on the subject of changes in wage rates and "a program for life, accident, health, medical and hospital insurance benefits". The wage increase resulted in a rate of $1.18½ for common surface labor, and a minimum underground rate of $1.23. The company-account miner's rate was increased to $1.29 per hour, or $10.32 per day, exclusive of the 5¢ per hour shift differential and overtime. The established contract miner's incentive pay rates remained the same, with the hourly increases added after calculating. The high contract pay for the year was $26.16 per day for a two-week period as compared with $20.24 per day the previous year, also exclusive of overtime and shift differential. The increase in the average wages in the following table reflects the wage increase, which was practically $1.00 per day and averaged $23.00 throughout the year.

MATHER MINE "A" SHAFT
ANNUAL REPORT
YEAR 1948

5. LABOR AND WAGES:
(Continued)

b. Comparative Statement of Wages and Product:
(Operating Only - Not including E&A Work)

	1948	1947
Product	1,001,001	729,669
Number of Shifts & Hours:		
Equiv. to	299½ 2-8 Hr.	291½ 2-8 Hr.
Average No. of Men Working:		
Surface	108-1/2	89-3/4
Underground	390-3/4	264-3/4
Total	499-1/4	354-1/2
Average Wages Per Day:		
Surface	$11.01	$10.16
Underground	12.66	11.77
Total	$12.30	$11.37
Wages Per Mo. of 25 Days:		
Surface	$275.25	$254.00
Underground	316.50	294.25
Total	$307.50	$284.25
Tons Per Man Per Day:		
Surface	30.67	27.42
Underground	8.57	9.26
Total	6.70	6.93
Labor Cost Per Ton:		
Surface	$ .359	$ .379
Underground	1.476	1.299
Total	$1.835	$1.678
Average Product Stoping	37.48	32.94
Average Wages Contract Miner	$15.40	$13.92
Total No. of Days:		
Surface	32,640	26,607-3/4
Underground	116,749-3/4	78,759
Total	149,389-3/4	105,366-3/4
Amount for Labor:		
Surface	$ 359,461.65	$ 270,492.04
Underground	1,477,602.88	927,313.91
Total	$1,837,064.53	$1,197,805.95
Proportion Surface to Underground Men	1:3.6	1:2.9

MATHER MINE "A" SHAFT
ANNUAL REPORT
YEAR 1948

6. SURFACE:

a. Buildings:

In addition to routine maintenance, one large project was completed. This was the installation of a second main boiler, three new hot water tanks and heating equipment for the underground ventilating air. The work was done under contract by the Walker-Jamar Company of Duluth and was completed and in operation by the end of the year.

b. Headframe:

The new design of the south pocket worked satisfactorily throughout the entire year, although some small changes to the design of the guillotine doors were indicated. As soon as possible, changes will be made in the north pocket along the same general design.

An overhead crane for handling cage changes was installed on the north side of the headframe.

c. Stockpiles and Stocking Trestles:

The extensions to the permanent trestles were completed by the Worden-Allen Company early in January, and the work of the mine crew was completed shortly thereafter. A season's use and experience indicated the necessity for additional extensions to provide more stocking capacity, and also speed up the stocking operation by providing a considerable length of double track. This project was designed and estimated late in the year, and an authorization was requested in December. The recommendations, if approved, will provide stocking room sufficient for normal operations. Sufficient additional stocking capacity can be obtained when needed by several different methods. Among these are included scraping or trucking beyond the ends of the permanent trestles, and scraping between the piles.

The first of several additional permanent loading tracks was installed by the Lake Superior & Ishpeming Railroad Company prior to resuming stockpiling in the fall. It is planned to install additional tracks, if this one proves satisfactory, which in the future will eliminate practically all necessity for temporary tracks.

MATHER MINE "A" SHAFT
ANNUAL REPORT
YEAR 1948

6. SURFACE:
(Continued)

c. Stockpiles and Stocking Trestles: (Continued)

Continued operating difficulties were experienced with the larry cars, which are now six years old. It was necessary, at great expense, to send parts of all three machines to the Lake Shore Engineering Company shops in Marquette for extensive overhauling. The balance of the repair work was done by the mine crew. The design of a new car was undertaken by the Design Service Company of Cleveland, Ohio and practically completed by the end of the year. This new car, three of which will ultimately be needed, will undoubtedly prove much more satisfactory than the present ones. All of the ore stocked after the completion of loading operations was handled with 15-ton Euclid trucks rented from the Tilden Mine. This was done for two reasons: The repairs to the larry cars were not yet completed, and the two present permanent stocking trestles do not afford sufficient room for the large production expected prior to the resumption of shipping.

d. Landscaping, Roads and Parking Area:

The water shortage made it almost impossible to keep the lawns, flower beds and shrubbery in top-notch condition, since all users of domestic water were requested to keep consumption to a minimum. With the exception of a new front entrance and a small amount of planting around it, there was no new work done. Snow removal continues to be a major problem and expense in spite of properly located snow fences. The very large parking area and the necessity for maintaining several miles of roads around the plant require a large amount of suitable plowing equipment.

e. Timber Tunnels:

The excavation of the rock in the open cut in the west timber yard was completed to the point where proper drainage can be obtained. With the increasing use of the east timber yard and tunnel, there will probably be no occasion to do any additional work in the west yard.

The excavation of the new east timber yard and the preparation of the railroad grades were completed by Lindberg & Sons, Contractors, early in the year. In general, the work in this new timber handling and storage yard progressed very satisfactorily. The permanent tracks were installed by the railroad company, and the mine crew completed the concrete ramp for loading timber trucks to the point where the yard could be put into use. Little or nothing additional will be done in this yard until practical experience can be gained by using it a year or so. It is entirely possible that no additional work will be required, with the possible exception of a small amount of concreting around the portal of the tunnel.

MATHER MINE "A" SHAFT
ANNUAL REPORT
YEAR 1948

6. SURFACE:
(Continued)

f. Surface Drainage:

The Layne-Northwest Company completed the fifth and last test hole, #62, early in the year at a depth of 115', with the static water level at 58'. This company also developed #1 Well at the location of Test Hole #59. Ledge was reached at 93', the well was completed in March with initial pumping attaining the volume of 300 G.P.M., and pumping was continued with Layne-Northwest equipment until July when the permanent equipment was received and installed. By the end of the year, the volume available for pumping in this well had decreased to approximately 110 G.P.M., with no important lowering of the static water in the other holes.

While continued pumping in #1 Well may ultimately remove a large portion of the water in the saturated overburden above the ore mining area, it is absolutely imperative that more information be obtained regarding the rate of caving in the large mining area above the 5th and 6th Levels. After a large amount of study, it was finally decided to put down Surface Hole #65 to a point in the mine where best judgment indicates the probability of the initial surface cave, if any. This is the first time in the history of the Company and the district where extensive mining is being carried on beneath a large diorite sheet. As a result, it is impossible to predict with any accuracy whatsoever, first, whether or not a cave will ever occur through to surface and, second, if a cave occurs, at what rate will it work its way to surface and when will it occur. On this information can very easily hinge the future of the entire property, since an unexpected and premature cave to surface could readily result in a disaster involving the lives of several hundred men. Accordingly, Hole #65 was started in the last week in June. The first phase of the work was done by the R. & S. Drilling Company of Clare, Michigan, utilizing oil well drilling technique and equipment, since it was absolutely imperative that the hole be kept perfectly plumb. The hard jasper encountered was so different from the material usually encountered in oil wells, that the R. & S. Drilling Company did not enjoy any particular success. Therefore, at a depth of 1,080', drilling by this company was discontinued and resumed with Company owned equipment and a Company crew. By the end of the year, the hole had reached a depth of 1,363', and was accurately on line, although drilling was stopped temporarily due to caving. The 1,363' depth is some 400' to 500' above the probable top of the cave. It is now planned to continue the hole at its present size, approximately 4" in diameter, for approximately 200', after which, accurate drilling no longer being necessary, it will be continued at a smaller size.

MATHER MINE "A" SHAFT
ANNUAL REPORT
YEAR 1948

6. SURFACE:
(Continued)

f. Surface Drainage: (Continued)
The completion of this hole will permit accurate studies of actual underground caving conditions and will relieve Management of any worry of premature caving which might trap all, or any portion of the underground crew. Additional study of surface conditions further to the east will be necessary as mining progresses, since a large portion of the area overlying the mining territories in both Sections One and Two is the drainage basin for tremendous quantities of surface water.

MATHER MINE "A" SHAFT
ANNUAL REPORT
YEAR 1948

7. UNDERGROUND:

a. Shaft Sinking:

There was no actual shaft sinking as such. However, preliminary work preparatory to raising the shaft to make the 7th Level available for mining was started. This will be discussed in detail in the discussion of operations on the new 6½ Level.

b. Development:

c. Stoping:

The trend from sub-level caving to radial stoping was continued throughout the year, with the caving method used only where deposits were too small to permit the stoping method. The only major change in the latter method was the use of 3" reverse feed stopers mounted on pneumatic columns, which had entirely replaced the 3½" automatic feed drifters by the end of the year. The new method is much faster and cheaper than the one which it outmoded, and the equipment is much lighter and easier to handle.

There was also a start on a mining method new to this property, block caving. The desirability of this method became more apparent as larger ore bodies were encountered. It is now obvious that this method should be used in most cases where judgment indicates the probability of caving jasper-capping due to the extent of the deposit. The system is not as elastic as radial stoping and requires considerably more development work prior to production. However, its use is definitely indicated in certain types of ore bodies. The development of one such block above the 5th Level was carried on throughout the last months of the year. This place will probably be ready for production sometime in February.

Some interesting figures have been obtained from two of the most successful radial stopes throughout the year, and are recorded here as a matter of interest.

Crew (a) spent a total elapsed time of eleven months from the starting of development work on the level to the completion of the stope. The development work required six months, during which time the 2-man, two shift crew drove 1,073' of miscellaneous raising and sub-level drifting in both ore and rock. This development work produced 13,200 tons of ore and 600 tons of rock during that six months period. Stoping was then started and the stope completed within the next five months, during which 58,000 tons of ore were produced at an average rate of 11,600 tons per month. The high point in this stope was in September, when 18,000 tons were produced, 9,834 of which were recovered in the last half of the month at an average rate of 200 tons per miner per shift. The average production for the entire 11 months period, including the development, was 6,500 tons per month.

MATHER MINE "A" SHAFT
ANNUAL REPORT
YEAR 1948

7. UNDERGROUND: (Continued)

b. Development:
c. Stoping:
(Continued)

Crew (b): During the year, this crew spent approximately two months on development and ten months stoping and produced 104,000 tons of ore at an average rate of 8,500 tons per month. This crew also hit a high for a two-week period at an average rate of 200 tons per miner per shift.

The following is a brief resume of the year's activities in the mining territories above the several levels:

2nd Level:
The mining area served by #3 and #4 Cross-cuts both north and south of #1 Dike was almost completely mined out from the +75' sub-level down to the -35' elevation. By the end of the year, the deposit north of the dike had been completely mined out and operations were being continued between #1 and #2 Dikes on the -35', -50' and -60' sub-levels from a new system of transfer drifts on the -75'. This new transfer system is also designed to mine the continuation of the deposit south of #2 Dike, where development operations were being continued at the end of the year.

East of #4 Cross-cut, mining operations were completed by a combination of sub-level stoping and sub-level caving from the -60' to the -100' and -110' sub-levels.

Mining operations were continued in the area west of #1 Cross-cut, which was the first area to be developed and opened at this property. Stoping and caving operations were continued from the transfer systems on the -75' and -85' sub-levels. At the end of the year, operations were being continued from a new transfer drift on the -110' in the north half of the area, and from the -125' sub-level in the southern portion. This territory continued to be one of the wetest mining areas in the mine.

Operations on the level were confined to two new ventilation connections from sub-levels below, and a small amount of mining in the vicinity of #5 Cross-cut from operations above the 3rd Level.

MATHER MINE "A" SHAFT
ANNUAL REPORT
YEAR 1948

7. UNDERGROUND: (Continued)

b. Development:
c. Stoping:
(Continued)

3rd Level:
Sub-level caving operations, above the transfer drift on the -185' sub-level east of #7 Cross-cut, early in the year completed the recovery of all of the remaining ore in the deposit. These operations included the mining of several pillars on the -140' sub-level.

There was a considerable amount of development work required to continue mining the deposit east of #4 Cross-cut and below #5 Cross-cut on the 2nd Level. A top timber transfer drift was driven south from the north footwall drift and a raise put up to the -185' sub-level, which is the bottom of the deposit. Mining and development operations were continued upward to the -140' sub-level and the 2nd Level above. There was also a considerable amount of work on the -160' sub-level.

There was also a small amount of development work on the -185' sub-level above #1 Cross-cut, where preparations were being made to continue the mining of that deposit below the 2nd Level. This work was done from a top timber transfer drift, #3106, on the -275' sub-level.

An entirely new development and exploration project was carried on in a new deposit from the new south footwall drift. Sub-level exploration was confined to a small amount of work on the -250' and -185' sub-levels. The information obtained to date has definitely indicated that the deposit is not as extensive as originally hoped. However, several satisfactory mining places will ultimately be developed.

Operations on the level were quite extensive. #1 Cross-cut was extended approximately 300' to the south for the ventilation and traveling connections from mining operations above the 5th Level.

The "Cambria Connection" was completed by drifting an additional 95' and putting up Raise #3080 to the 7th Level of the Cambria-Jackson Mine.

The most extensive project was the driving of the new south footwall drift, some portions of which were in ore. #4 Cross-cut was driven in its normal position, and the new footwall drift was driven east from this cross-cut to #7 Cross-cut. #5 Cross-cut was also driven south of this drift a short distance. This work was all done in order to make available the ore in the new deposit later discussed in Underground Hole #45. As was previously mentioned, the area is not nearly as extensive as originally hoped. The deposit is also quite high in sulphur.

MATHER MINE "A" SHAFT
ANNUAL REPORT
YEAR 1948

7. UNDERGROUND: (Continued)

b. Development:
c. Stoping:
(Continued)

5th Level:
In the area west of the fault and north of #5 Dike, an extensive new transfer system was developed on the -360' sub-level. Ten new transfer drifts were driven north of a main east-west connecting drift, distances varying from 120' to 160'. In all cases, it was necessary to continue these drifts a considerable distance into the footwall in order to completely recover the ore above. Operations above this transfer system were carried on on the -325' and -300' sub-levels, and were continued up to approximately 40' above the 3rd Level. Practically all of the ore recovered in this operation was quite high in sulphur. Toward the latter part of the year, development work was started to continue this mining operation below the -360'. This work consisted of a top timber transfer drift, #5102, on the -570' and a raise of the same number, which was up 120' by the end of the year.

In the area west of the fault and south of #5 Dike, mining operations on the -390' sub-level completed the recovery of all of the ore above that elevation. Mining in this deposit was continued from a main transfer drift on the -510' sub-level and continued upward to the floor of the -390'. Development in this deposit was being continued at the end of the year on the -570' and -510' sub-levels. In general, the ore in this area was quite low in sulphur.

In the area east of the fault and north of #5 Dike, stoping, caving and development work were carried on from the -360' elevation down to the 5th Level. In this area, which was the largest single producer during the year, operations were very extensive and the ore recovered was both high and low in sulphur. By the end of the year, operations were almost entirely confined to development work, including two new block caves, one in the northwest corner, and the other in the southwest portion of the area.

A continuation of mining in the area east of the fault and south of #5 Dike practically completed the recovery of all of the ore above the 5th Level. There still remain relatively small reserves, most of which will be recovered from the 6th Level. These operations extended from the -400' elevation to the level at elevation -580.

MATHER MINE "A" SHAFT
ANNUAL REPORT
YEAR 1948

7. UNDERGROUND:(Continued)

b. Development:
c. Stoping:
(Continued)

5th Level: (Continued)
There was a considerable amount of activity in the area served by #4, #5 and #6 Cross-cuts. In general, this deposit pitches upwards both to the west and east, with the higher limb on the east side. Exploration on the west side was carried up to the -500' elevation. Information obtained indicated that the proper approach in this half of the deposit was to defer mining operations until the new 6th Level stoping area was ready. Mining from this area had reached the -500' elevation by the end of the year, and had recovered all of the ore down to the 5th Level.

The easterly portion of this deposit pitches upwards to a considerable height above the 5th Level, and was explored, developed and mined to the -450' elevation. Two major stopes were developed in this area during the year, one of which was practically finished, and the other just nearing the production stage in December. Although there was some very high sulphur ore encountered in the upper portions, in general this deposit was Standard grade.

There was a considerable amount of exploration and development work done in the relatively small deposit originally encountered in the south end of #7 Cross-cut on the 3rd Level immediately north of #4 Dike. This deposit was quite extensively drilled on the -435' elevation from drifts driven from the main ventilation connection #5701 between the 5th and 3rd Levels. A rather extensive transfer system was completed on the -325' and -390' sub-levels, and development work was being continued at the end of the year on the -300' and -360' sub-levels. In general, this entire deposit is rather high in sulphur.

On the level, operations were confined to mining and ventilation raises above, and two ventilation connections from the 6th Level below.

MATHER MINE "A" SHAFT
ANNUAL REPORT
YEAR 1948

7. UNDERGROUND: (Continued)

b. Development:
c. Stoping:
(Continued)

6th Level:
By far the most important operation above this level during the year was exploration, development and mining in the deposit northeast of the main fault and northwest of #4 Dike, served by #3, #4 and #5 Cross-cuts. Initial development was accomplished by means of an extensive loading transfer sub-level on the -725' elevation immediately above the level. These drifts, which were driven in the interbedded ore, connected #3, #4 and #5 Cross-cuts and included a short drift west of #3. Raises from this car loading system were then put up through the interbedded slate to the main mining transfer sub-level on the -650' sub-level, where mining raises were then put up to the north to the main stoping transfer sub at elevation -615. At this point, stope transfers were driven to the north under the deposit between #3, #4 and #5 Cross-cuts on the 5th Level, which at times was used as a drilling sub-level for the stoping operations below. During the latter part of the year, this territory was one of the most important producers in the mine. Operations, which were carried on as a combination of radial stoping and sub-level caving, extended to the -500' elevation above the 5th Level. By the end of the year, development work in advance of mining operations was being carried on in the west portion of this deposit on the 5th Level elevation just east of #4 Cross-cut, and on the -675' elevation in a new transfer system to the south.

Toward the latter part of the year, development operations were started between #4 and #5 Cross-cuts, south of #4 Dike and east of the fault in a top timber car loading transfer system on the -725' elevation. By the end of the year, this work had reached the -700' elevation and was being continued above on the -675' elevation, where a small mining operation was started in December.

Additional sub-level development work was confined to a small operation southwest of the fault, north of #4 Dike and above #2 and #3 Cross-cuts, with a transfer system on the -700' elevation, and exploration and development work being continued on the -675' and -650' sub-levels. Geologically speaking, this should have been a rather extensive deposit. Actually, reserves are very limited and extremely spotty.

MATHER MINE "A" SHAFT
ANNUAL REPORT
YEAR 1948

7. UNDERGROUND: (Continued)

b. Development:
c. Stoping:
(Continued)

6th Level: (Continued)
By far the largest amount of main level drifting and cross-cutting was done on the 6th Level during the year. #4 and #5 Cross-cuts were completed into the jasper capping beyond the ore south of #4 Dike, both approximately 600' from the main footwall drift, which itself was extended approximately 300' beyond the normal position of #9 Cross-cut, or 400' short of the "B" Shaft boundary. #6 Cross-cut was extended around the curve a short distance byond the P.T., where drilling to the south indicated the futility of continuing. #7 Cross-cut was drilled in a like fashion and subsequent drilling indicated the necessity of continuing it into the jasper capping 100' south of #8 Dike and some 700' south of the main drift. #8 Cross-cut was swung to the southeast and driven 500' from the main drift into the slates beyond the interbedded ore. Extensive drilling to the south of this drift has to date disclosed no deposits extensive enough to warrant further cross-cutting. #5 Cross-cut North was driven approximately 130' north of the main footwall drift to provide a battery charging station and also a top timber loading transfer for the ventilation raise which was put up to the 5th Level.

6½ Level:
This development was originally conceived as a skip loading level supplementary to the 6th Level to provide storage and more effective handling of either ore or rock. The scope of the project was later enlarged to include a rock handling level for the shaft deepening project, and also a much more effective and efficient method of handling skip pit spillage. The original openings were made in January from the east side of the skip compartments, where a temporary pocket was installed to permit the driving of the scraping drift to the north and an entrance drift to the south. This latter opening was then joined with a traveling drift south of the cage compartment. A raise was then put up to the 6th Level from the north end of the scraping drift and arrangements were made on the level to dump the cars by means of pneumatic cylinders similar to the main shaft pocket installation. While this work was progressing, plans were developed for putting down a winze and deepening the shaft to make the 7th Level available as soon as possible. This necessitated additional work consisting of a small cut-out to house the sinking hoist, two traveling drifts connecting this engine house with the scraping drift, and a very flat raise from the engine house to the winze head

MATHER MINE "A" SHAFT
ANNUAL REPORT
YEAR 1948

7. UNDERGROUND: (Continued)

b. Development:
c. Stoping:
(Continued)

6½ Level: (Continued)
sheave. All of this initial work was completed by August, when the sinking of the winze was begun. By the end of November, this two-compartment winze was completed at a depth of 203' below the floor of the 6½ Level, with enough depth below the new 7th Level skip pit elevation to permit the spotting of the small skip. By the end of the year, permanent runners had been installed, the dump arrangement completed on the 6½ Level and loading pockets had been installed on the old 6th Level skip pit (-888'), on a sub-level under the shaft pentice (-916') and at the new skip pit elevation (-1000').

From the loading pocket at the old skip pit elevation, a drift was driven to the south and connected with the original opening at the old shaft bottom. This permitted the installation of facilities to handle the skip pit spillage, via the winze, in a much more effective manner than the original installation. At the pentice elevation, a short drift was driven to the west of the winze preparatory to making a connection under the shaft. At the new skip pit elevation, a large scraping drift was driven down grade from the pocket elevation at -1000' to a skip pit floor elevation of -1015'. This drift had just passed the shaft location by the end of the year. It is hoped that this shaft deepening project will be completed by the latter part of the summer, after which the opening of the new 7th Level will be carried on as rapidly as possible. This new level, which will be developed at a depth of 200' below the 6th Level, is urgently needed if the large volume of production is to be maintained and increased. If necessary, the winze can be deepened to permit the development of the 8th Level if the time schedule requires it.

MATHER MINE "A" SHAFT
ANNUAL REPORT
YEAR 1948

7. UNDERGROUND:
(Continued)

d. Timbering:

In general, 8' hardwood stull timber was used throughout the mining sub-levels, although there was a considerable increase in the use of 9' timber in some mining operations requiring larger drifts. The use of steel was increased both on the sub-levels and the main level drifts. On the sub-levels, steel was used in a number of important transfer drifts where extreme weight was either anticipated or encountered, and where the need for repair work would have proved very costly due to the loss of production. In all cases, the use of steel was completely justified by the results obtained. There was also an increase in the use of narrow steel plates for lining important ore passes and draw raises, with extremely gratifying results. On the main levels, a very large amount of steel was used to replace the timber in existing rock drifts where the length of life warranted the use of steel. In addition, a system was worked out which now makes it possible to install steel sets as the main drifts are being driven. This took a considerable amount of study and experimentation to avoid damaging the steel during blasting. There still remain several thousand feet of main level drifts and plats where the timber will be replaced with steel in the next year or so.

A new development was the design and testing of concrete slabs to replace lagging and blocking where fireproofing is necessary. All of the wood in and around the main level plats is being removed and replaced with these concrete slabs and cinder blocks. This work, when completed, makes the support of the openings absolutely permanent and fireproof; and is a neat workman-like job. The poles, blocking and lagging in the main level drifts adjacent to powder magazines were also replaced in a like manner. In the remainder of main level drifts where fireproofing was desirable but not practical, the concrete slabs were used to replace the tamarack carrying poles, which lose more than 3/4 of their strength within the first three or four years. In the drifts, fire stops are put in every 300' to 400' and adjacent to main air-ways by removing all of the wood for a distance of 10' to 15' and replacing with the concrete supplies. This material, which was designed and tested by the mine personnel in connection with the supplier, is being obtained from the Northern State Dunbrik Company of Marquette. The slabs are made of blown slag aggregate and are reinforced with three rods, giving an ultimate strength of between 1,500 and 1,600 pounds concentrated load on a 5' span. Currently, they are being furnished 2¼" thick, 8" wide and 6' long.

MATHER MINE "A" SHAFT
ANNUAL REPORT
YEAR 1948

7. UNDERGROUND:
(Continued)

d. Timbering: (Continued)

The following table is a record of all timber and timbering supplies used during the year on all operations. The figures reflect the increased operation, general increases in supply costs, the increased use of steel and concrete supplies and the large amount of main level repair work done during the year. By the end of the year, approximately 50% of the 2,235' of main level plats was completely fireproofed with steel sets and concrete slabs. The 6th Level was complete, the 5th Level 30% complete and the work on the 2nd and 3rd had not yet been started. Of the 30,000' of main level drifts and cross-cuts in operation, approximately one-half must ultimately be supported with steel and concrete back poles. Of this, the installation of steel sets was 80% complete, with most of the back poles yet to be installed. The expense of both the material and labor in these operations was carried on the cost sheet under "Timbering".

Statement of Timber Used - All Operations

	LINEAL FEET	AVG. PRICE PER FOOT	AMOUNT 1948	AMOUNT 1947
5'4" Cribbing	221,416	.07907	$ 17,507.10	$11,167.95
8" - 10" Stulls	28,784	.12327	3,548.23	6,440.11
10" - 12" Stulls	95,917	.17744	17,019.82	12,261.55
12" - 16" Stulls	50,330	.21154	10,647.00	6,374.52
16' & 18' Mining Timber	1,617	.17749	287.00	603.76
Total	398,064	.12311	$ 49,009.15	
Total 1947	306,394	.11700		$35,847.89
		PER 100'		
7' Lagging	1,972,663	1.5944	$ 31,451.40	$23,182.68
9½' Poles	665,000	2.9220	19,431.16	12,080.63
Total	2,637,663	1.9291	$ 50,882.56	
Total 1947	1,999,898	1.7633		$35,263.31
		PER FOOT		
4" x 4" "H" Beam 13# Per Foot	62,849	.55335	$ 34,777.35	$12,493.75
4" x 8" "I" Beam 23# Per Foot	3,256	.80570	2,623.37	1,497.66
3/8" x 2" x 2" Angle Iron	102,155 lbs.	.04346	4,439.70	1,085.66
Miscl. (Bolts, Plates, etc.)			3,481.76	1,194.09
Total			$ 45,322.18	
Total 1947				$16,271.16
2¼" x 8" x 6' Minecrete Poles	47,832	.22021	$ 10,533.20	
4" x 8" x 12" Minecrete Blocks	1,124 pcs.	.15	168.60	
6" x 8" x 12" Minecrete Blocks	890 pcs.	.19	169.10	
8" x 8" x 12" Minecrete Blocks	1,366 pcs.	.23	314.18	
Total			$ 11,185.08	
Total 1947				.00
GRAND TOTAL INCLUDING STEEL AND CONCRETE			$156,398.97	$87,382.36

MATHER MINE "A" SHAFT
ANNUAL REPORT
YEAR 1948

7. UNDERGROUND:
(Continued)

d. Timbering: (Continued)

The cost per ton for timbering supplies includes almost $54,000.00 worth of steel and concrete, most of which was used in repairing main level drifts and plats. In spite of the increased production, this cost increased due to the large repair program, which will be continued until completed.

Statement of Timber Used Under Operating Account "Timbering":

	LINEAL FEET	AVG. PRICE PER FOOT	AMOUNT 1948	AMOUNT 1947
5'4" Cribbing	207,816	.07910	$ 16,438.95	$11,152.70
8" - 10" Stulls	26,910	.12283	3,305.48	6,013.59
10" - 12" Stulls	85,199	.17660	15,046.47	10,086.49
12" - 16" Stulls	41,983	.21543	9,044.23	5,145.78
16' & 18' Mining Timber	1,103	.18325	202.12	466.21
Total	363,011	.12131	$ 44,037.25	
Total 1947	288,420	.11395		$32,864.77
		PER 100'		
7' Lagging	1,639,934	1.5912	$ 26,095.07	$18,294.30
9½' Poles	524,152	2.9280	15,346.99	9,001.73
Total	2,164,086	1.9150	$ 41,442.06	
Total 1947	1,555,082	1.7553		$27,296.03
		PER FOOT		
4" x 4" "H" Beam 13# Per Foot	59,221	.55214	$ 32,698.46	$10,534.04
4" x 8" "I" Beam 23# Per Foot	2,970	.79952	2,374.57	1,294.19
3/8" x 2" x 2" Angle Iron	96,154 lbs.	.043538	4,186.37	964.00
Miscl. (Bolts, Plates, etc.)			3,294.38	949.13
Total			$ 42,553.78	
Total 1947				$13,741.36
2¼" x 8" x 6' Minecrete Poles	47,832	.22021	$ 10,533.20	
4" x 8" x 12" Minecrete Blocks	1,124 pcs.	.15	168.60	
6" x 8" x 12" Minecrete Blocks	890 pcs.	.19	169.10	
8" x 8" x 12" Minecrete Blocks	1,366 pcs.	.23	314.18	
Total			$ 11,185.08	
Total 1947				.00
GRAND TOTAL INCLUDING STEEL AND CONCRETE			$139,218.17	$73,902.16

	1948	1947
Product for Year	1,001,001	729,669
Ft. Timber per Ton of Ore	.3626	.3953
Ft. Lagging per Ton of Ore	1.6383	1.6343
Ft. Poles per Ton of Ore	.5236	.4969
Ft. Lagging per ft. of Timber	4.5175	4.1345
Cost per Ton for Timber	.0440	.0450
Cost Per Ton for Lagging	.0261	.0251
Cost Per Ton for Poles	.0153	.0123
Cost per Ton for Steel and Concrete Supplies	.0537	.0188
Cost per Ton for All Timbering Supplies, Including Steel and Concrete Supplies	.1391	.1012

MATHER MINE "A" SHAFT
ANNUAL REPORT
YEAR 1948

7. UNDERGROUND:
(Continued)

d. Timbering: (Continued)

Amount and Cost of Timber Used in 4,705' of Main Level Timbered Rock Drift

	LINEAL FEET	AMOUNT	AMOUNT PER FT. TBRD. DRIFT
8" - 10" Stulls	1,874	$ 242.75	
10" - 12" Stulls	10,691	1,967.09	
12" - 16" Stulls	8,347	1,602.77	
16' & 18' Mining Timber	514	84.88	
Total	21,426	$ 3,897.49	.8284

Amount and Cost of Poles & Lagging for 5,337' of Main Level Timbered Rock Drift

7' Lagging	327,927	$ 5,279.52	
9½' Poles	139,850	4,054.24	
Total	467,777	$ 9,333.76	1.7489

Total Per Foot of Timbered Drift..... 2.5773

Amount and Cost of Steel & Steel Supplies Used in 632' of New Main Level Rock Drift Supported by Steel Sets

4" x 4" "H" Beams 13#	3,061	$ 1,794.33	
4" x 8" "I" Beams 23#	276	241.56	
3/8" x 2" x 2" Angle Iron	5,107#	214.13	
Miscl. (Bolts, Plates, etc.)		161.64	
Total	3,337	$ 2,411.66	3.8159

Total Per Foot Including Lagging & Poles..... 5.5648

GRAND TOTAL INCLUDING STEEL..... $15,642.91

The average cost per foot for timbering supplies in main level rock drifts supported with timber increased from $2.16 to $2.58 per foot, as is to be expected with normal rising costs of purchased supplies. The cost per foot for supplies in 632' of drift supported by steel sets as driven increased from $4.74 to $5.56 for the same reason. In spite of this, the average cost per foot for main level rock drift decreased due to increased speed as a result of new modern equipment, and the small opening required when steel is installed as the drift is driven.

MATHER MINE "A" SHAFT
ANNUAL REPORT
YEAR 1948

7. UNDERGROUND:
(Continued)

e. Drifting and Raising:

The following table includes all of the miscellaneous development work on all operations throughout the year. Main level drifting was confined to the 3rd and 6th Levels. The table also includes the work on the new 6½ Level, the new skip pit and the double-compartment winze, which is included under "Large Rock Raise Cribbed".

	Drifting		Raising		
	Ore	Rock	Ore	Rock	Total
Large Size	14,193'*	10,259'**	333'***	1,344'±	26,129'
Small Size	4,453'	1,303'	12,176'‡‡	2,901'‡‡‡	20,833'
	18,646'	11,562'	12,509'	4,245'	46,962'
				Grand Total Last Year.....	38,452'

* Timbered
** 9,122' Timbered
*** 329' Cribbed
± 1,290' Cribbed
‡‡ 4,422' Cribbed
‡‡‡ 1,494' Cribbed

The only main level rock drift which was not charged to E&A's NM-27A and 60 was 95' on the 3rd Level in the completion of the so-called "Cambria Connection". This is shown in the following table, along with the drifting on the 3rd and 6th Levels.

	Timbered Ore Drift	Timbered Rock Drift	Naked Rock Drift	Total
3rd Level Cambria Connection			95'	95'
E&A NM-60 3rd Level	413'	1,488'	67'	1,968'
E&A NM-27A 6th Level	624'	3,849'		4,473'
Total	1,037'	5,337'	162'	6,536'
Total 1947	881'	4,821'	382'	6,084'

In addition to the above work, there were 307' of raising and small size drifting to connect the 3rd Level drift with the 7th Level of the Cambria-Jackson Mine, 526' of miscellaneous raising and sub-level drifting in ventilation connections between the 5th and 3rd Levels (NM-26A) and 403' of similar work between the 6th and 5th Levels (NM-27A).

MATHER MINE "A" SHAFT
ANNUAL REPORT
YEAR 1948

7. UNDERGROUND:
(Continued)

f. Explosives, Drilling and Blasting:

The average price paid for explosives during the year increased 3.75% from $13.80 to $14.32. There were a number of interesting changes in the types and sizes of explosives used: There was a large increase in the use of Hercomite #2 - 2" x 24" due to the increased activity in long hole radial stoping. There was a considerable decrease in the smaller sizes of the more expensive Gelatin powder. A new use of powder was developed at this property and a new cartridge was designed with the aid of engineers of the Hercules Powder Company. This is the now well known "5 x 5 Bomb". These "5 x 5" cartridges, containing 5 pounds of 60% high pressure Gelatin powder, have proved extremely effective in the blasting of chunks in the throats of draw raises in all types of mining. They are much more satisfactory than bombs heretofore used, which were made by tying a number of 1¼" x 8" sticks together. In addition to being much more effective in breaking the chunks, they are much less destructive to the cribbed openings.

The following table is a record of all explosives and supplies used on all operations during the year.

	Quantity	Average Price	Amount 1948	Amount 1947
40% Gelatin	-	-	-	$ 1,184.80
60% Gelatin 1¼" x 8"	41,466#	16.548 CWT	$ 6,861.83	8,409.16
60% Gelatin 4" x 16"	900#	20.000 CWT	180.00	-
60% Gelatin H.P. 5" x 5#	33,552#	20.000 CWT	6,710.32	-
80% Gelatin	2,366#	19.000 CWT	449.54	1,136.96
Gelamite #1	-	-	-	142.50
Hercomite #2x - 1¼" x 8"	430,973#	13.694 CWT	59,017.21	46,139.95
Hercomite #2 - 2" x 24"	101,630#	14.035 CWT	14,263.50	3,948.76
Total Powder	610,887#	14.321 CWT	$ 87,482.40	
Total Powder 1947	441,705#	13.801 CWT		$60,962.13
Blasting Fuse	1,297,906'	8.026 M	$ 10,417.27	$ 6,996.35
No. 6 Blasting Caps	160,874	1.386 C	2,229.79	1,727.51
No. 14 Lead Wire	57,125'	26.000 M	1,485.25	1,176.03
Electric Blasting Caps	50,927	17.850 C	9,090.44	7,136.60
7" Fuse Lighters	23,625	9.769 M	230.80	197.82
Paper Shells	18,200	7.666 M	139.52	135.77
#1 Powder Bags	19	1.568 ea.	29.79	17.26
#2 Powder Bags	170	4.500 ea.	765.00	827.39
Primacord	227,000'	3.200 C	7,264.00	1,404.80
Total Fuse, Caps, Wire, etc.....			$ 31,651.86	$19,619.53
GRAND TOTAL EXPLOSIVES & BLASTING SUPPLIES.....			$119,134.26	$80,581.66

MATHER MINE "A" SHAFT
ANNUAL REPORT
YEAR 1948

7. UNDERGROUND:
(Continued)

f. Explosives, Drilling and Blasting: (Continued)
The amount of explosives used per ton of ore remained practically the same throughout the entire year. The increase in the cost of blasting supplies other than powder was considerably greater than for the powder itself. The increase in the cost per ton for explosives reflects both supply cost increases.

Explosives Used in Breaking 1,001,001 Tons of Ore in Stoping and Development in Ore

	Quantity	Average Price	Amount 1948	Amount 1947
40% Gelatin	-	-	-	$ 1,184.80
60% Gelatin 1¼" x 8"	9,189#	15.433 CWT	$ 1,418.10	1,999.95
60% Gelatin 4" x 16"	850#	20.000 CWT	170.00	-
60% Gelatin H.P. 5" x 5#	33,202#	20.000 CWT	6,640.32	-
80% Gelatin	568#	19.000 CWT	107.92	609.14
Gelamite #1	-	-	-	142.50
Hercomite #2x - 1¼" x 8"	279,475#	13.913 CWT	38,883.93	34,477.11
Hercomite #2 - 2" x 24"	101,130#	14.037 CWT	14,195.50	3,913.12
Total Powder	424,414#	14.471 CWT	$61,415.77	
Total Powder 1947	310,490#	13.632 CWT		$42,326.62
Blasting Fuse	1,090,765'	8.010 M	$ 8,737.29	$ 6,376.69
No. 6 Blasting Caps	133,448	1.385 C	1,848.83	1,567.59
No. 14 Lead Wire	16,910'	26.000 M	439.66	163.10
Electric Blasting Caps	11,841	17.518 C	2,074.26	1,244.30
7" Fuse Lighters	21,750	9.835 M	213.91	147.19
Paper Shells	18,200	7.666 M	139.52	119.91
#1 Powder Bags	17	1.568 ea.	26.65	17.26
#2 Powder Bags	130	4.500 ea.	585.00	733.86
Primacord	220,286'	3.200 C	7,049.14	980.80
Total Caps, Wire, Fuse, etc.....			$21,114.26	$11,350.70
GRAND TOTAL EXPLOSIVES & BLASTING SUPPLIES.....			$82,530.03	$53,677.32

	1948	1947
Product	1,001,001	729,669
Pounds of Powder per Ton of Ore	.424	.426
Tons of Ore per Pound of Powder	2.359	2.350
Cost per Ton for Powder	.061	.058
Cost per Ton for Fuse, Caps, etc.	.021	.016
Cost per Ton for all Explosives	.082	.074

In addition to the above, explosives costing $11,804.80 were used in miscellaneous rock work which was charged to "Development in Rock". This amount compares with $5,463.25 in 1947 and $2,500.12 in 1946.

MATHER MINE "A" SHAFT
ANNUAL REPORT
YEAR 1948

7. UNDERGROUND:
(Continued)

f. Explosives, Drilling and Blasting: (Continued)

Explosives Used in Driving 5,404' of Main Level Rock Drift
E&A's NM-27A and 60

	Quantity	Amount	Pounds of Powder Per Foot of Drift	Cost Per Foot
60% Gelatin 1¼" x 8"	10,672#	$ 1,765.09		
60% Gelatin 4" x 16"	50#	10.00		
80% Gelatin	757#	143.83		
Hercomite #2x - 1¼" x 8"	94,574#	12,055.60		
Hercomite #2 - 2" x 24"	450#	60.75		
Total Powder	106,503#	$14,035.27	19.71	2.60
Miscl. Blasting Supplies		$ 6,251.36	-	1.15
Grand Total		$20,286.63	19.71	3.75
Grand Total 1947 - 4,536'			16.02	3.29

The cost per foot for explosives reflects the general increases in the purchase prices, and an increase in the amount of powder used per foot of drift due to harder material encountered. The Hercomite #2x - 1¼" x 8" was used throughout the year in connection with 60% Gelatin used as the detonating cartridge. Some difficulty was encountered with missed holes due to the tendency of Hercomite powder to absorb water very rapidly. Early in the year, it is planned to resume the use of the more expensive Gelamite #1 to eliminate this hazard.

MATHER MINE "A" SHAFT
ANNUAL REPORT
YEAR 1948

7. UNDERGROUND:
(Continued)

g. Loading and Tramming:

The drifting programs on the 3rd and 6th Levels kept two of the three Conway Model 125 electric loaders working almost constantly throughout the year on a three shift basis. This made it possible, by utilizing the third machine as a spare, to keep all of this equipment in good operating condition. Except for the heavy maintenance, which is now regarded as normal, there was no undue expense or delay due to breakdowns. A Model 40 Hydro-electric loader was ordered from the Eimco Corporation with the hope that delivery could be effected late in the year. This machine was ordered for the express purpose of comparing efficiency and maintenance costs so as to provide a basis for a decision for purchasing loaders for "B" Shaft. Our experience with Eimco loaders is excellent and there is every reason to believe that the performance will be the equal of the Conway and the maintenance costs much less. Due to design changes, delivery was not made during the year, but was expected early in 1949, leaving ample time for comparative studies prior to ordering the equipment for "B" Shaft.

The Lake Shore 100 cubic foot "Lohed" cars continued to work with complete satisfaction in both ore and rock. Twelve new units were purchased and delivered during the year, bringing the total to 66, this number in addition to 32 others of competitive make and design. These competitive cars, manufactured by the Pressed Steel Car Company of Pittsburgh, Pennsylvania and the C. S. Card Iron Works of Denver, Colorado, were continued in use but are definitely limited as to application. This is particularly true of the Card cars, which can be used only on rock work, since they will not stay closed when loaded with heavy, wet ore. The experiments with lining the bottoms of all of these cars with 1" thick rubber "Blankets" worked out extremely well, with the result that most of the cars were so lined by the end of the year. This necessitated an expenditure of almost $100.00 per car, which expense is well warranted in view of the reduction in the amount of labor and time required to keep them clean.

Four additional General Electric storage battery locomotives were received during the year, these being of the new "custom made design" worked out at this plant several years ago. The use of the original three, which were very poorly adapted to the conditions at this plant, is now restricted, with two of them on surface in the timber tunnels and the third destined to be sent to "B" Shaft for the same purpose. Exhaustive studies of the electric haulage problems have indicated the desirability of using a considerable number of combination battery and trolley locomotives, ten of which were ordered for "B" Shaft from the Goodman Manufacturing Company and the Jeffrey Manufacturing Company. It is now planned to use at least two of these new locomotives for driving the new 7th Level at "A", replacing these at "B" Shaft with two straight battery locomotives.

MATHER MINE "A" SHAFT
ANNUAL REPORT
YEAR 1948

7. UNDERGROUND:
(Continued)

h. Ventilation:

Two important additions to the ventilating system were installed and in operation by the end of the year. The first, a 100,000 C.F.M. ventilating fan purchased from the Joy Manufacturing Company, was installed early in the year and operated at an initial volume of 70,000 C.F.M., which was later increased to approximately 90,000. Of these volumes, 25% to 30% is deliberately recirculated, the balance being the amount of fresh air introduced into the circuit. With such high volumes, the resulting velocities and pressures are quite high, a condition which necessitates constant surveillance to keep the amount of recirculated air at approximately the above figure. Relatively small leaks in the ventilation seal in the shaft can quickly increase the amount of recirculation above the desired figure.

The second major addition to the ventilating system was the shaft heating plant, the installation of which was also completed early in the year. As was explained in last year's report, this system involves an air shaft west of and adjacent to the cage compartment, through which preheated air is introduced into the shaft below the normal spotting position of the cage at the tunnels. The heating plant consists of a large bank of steam unit heaters and a low pressure fan with a capacity of 76,000 C.F.M. During moderately cold weather, it is not necessary to run the fan, since sufficient heat is obtained by merely drawing the intake air through the heaters. In sub-zero weather, the operation of the fan during the day shift sufficed to keep the cage compartment completely free of ice. These observations, of course, were made during one of the mildest winters on record. During a normal winter, more or less continuous operation of the fan will be necessary during the colder months.

In general, the same ventilation system was continued, with the fresh air entering through the cage compartment and introduced into the mine on the 3rd Level. The relatively small portion needed for ventilating the 2nd Level workings is permitted to exhaust into the skip roads onto the 2nd Level, with the balance forced down through the workings to the 5th and 6th Levels and exhausted into the skip roads. In general, the ventilation system was quite satisfactory, with numerous sub-level connections in both ore and rock being made as necessary.

Two new permanent connections in the main ventilation system were completed, #518 between the 5th and 3rd Levels and #6590 between the 6th and 5th Levels. A third permanent ventilation connection was started from the 6th Level in October by means of a long inclined rock drift on the -700' elevation from the tops of Raises #6801 and #6803. This drift is necessary to carry the raise connection north into the footwall before connecting with the 5th Level.

MATHER MINE "A" SHAFT
ANNUAL REPORT
YEAR 1948

7. UNDERGROUND:
(Continued)

i. Pumping:

The concreting of the new 6th Level pumphouse was completed by the Intrusion-Prepakt Company in January. The welded discharge line was completed in February and the installation of #1 pump in April, at which time pumping was started. The installation of #2 and #3 pumps was completed in July, after which the three units were operated alternately throughout the balance of the year. The placing of the permanent concrete floors, the painting of the walls and equipment and other work were continued with a small crew throughout the balance of the year. The completion of this new pumping station provides a comfortable margin, with a total capacity on this level of 1,500 G.P.M. This, combined with the capacities of 650 G.P.M. on the 3rd Level and 630 on the 960' Level, results in a total theoretical capacity of practically 2,800 G.P.M. The 6th Level pumping plant, of course, is designed to handle all of the "B" Shaft water above this elevation.

The following table is submitted as a matter of interest, showing the gradual increase in the underground water throughout the spring break-up and the gradual decrease toward the end of the year. At times, the volume on the 960' Level was hardly sufficient for underground drilling purposes. The only unusual increase was a quick rise in the volume on the 6th Level late in the year, which, although reaching a peak of approximately 300 G.P.M., did not last long enough to materially effect the average.

	3rd Level	960' Level	6th Level	Total
January	206	25		231
February	202	24		226
March	200	20		220
April	105	42	95	242
May	61	44	136	241
June	63	36	133	232
July	60	27	131	218
August	60	20	129	209
September	58	9	136	203
October	55	7	125	187
November	52	2	132	186
December	50	7	140	197

Total gallons 1948 - 114,352,596 at an average of 217 G.P.M.

MATHER MINE "A" SHAFT
ANNUAL REPORT
YEAR 1948

8. COST OF OPENING, EQUIPPING, DEVELOPING AND OPERATING:

a. Comparative Mining Costs:
The substantial increase in production did not offset either the general increases in labor and supply costs, or several unusually expensive operations. The increased development program necessitated an increase in "Development in Rock". The increase in "Timbering" of $.16 per ton is easily explained by the large repair program which was necessary. The charge of $.08 per ton under "Cave-In" was a new item. A small decrease was noted in "Surface Costs", where the increased production had some effect.

	1948	1947
Product - Tons	1,001,001	729,669
Underground Costs	2.342	1.900
Surface Costs	.273	.285
General Mine Expense	.409	.384
Cost of Production	3.024	2.569
Depreciation: Plant & Equipment	.044	.106
Development after 12/31/44	.109	.109
Pre-Production Development	.036	.036
Movable Equipment	.005	.004
Taxes	.162	.163
Loading and Shipping	.049	.049
Total Cost at Mine	3.429	3.036
Budget - Estimated Cost Per Ton	3.485	2.915
Number of Shifts and Hours	299½ 2-8 Hr.*	291½ 2-8 Hr.
Total 8 hr. Operating Shifts	599*	583
Number of Operating Days	299½ 2-8 Hr.	291½ 2-8 Hr.
Average Daily Product	3,342	2,503

* As was previously mentioned, the operation was practically on a three shift basis by the end of the year.

Proportion of Labor and Supplies

	Amount	Per Ton	Per Cent
Labor	$1,966,375.05	1.964	57%
Supplies	1,465,928.47	1.465	43%
Total Cost at Mine	$3,432,303.52	3.429	100%

MATHER MINE "A" SHAFT
ANNUAL REPORT
YEAR 1948

8. COST OF OPERATING: (Continued)

b. Detailed Cost Comparison:

	1948		1947	
	Amount	Per Ton	Amount	Per Ton
Exploring in Mine	38,193.46	.038	24,898.68	.034
Development in Rock	105,047.80	.105	38,519.43	.053
Development in Ore	55,266.03	.055	51,230.14	.070
Stoping	755,231.88	.754	499,597.50	.684
Timbering	625,835.17	.625	336,855.74	.462
Tramming	258,172.81	.258	173,421.96	.238
Ventilation	18,658.51	.019	11,649.32	.016
Pumping	20,856.23	.021	29,506.84	.040
Compressors and Air Pipes	76,991.69	.077	42,225.59	.058
Underground Superintendence	93,820.12	.094	48,995.86	.067
Cave-in, or Fire in Mine	81,167.86	.081	-	-
Maint. Comp. & Power Drills	13,148.98	.013	384.35	.000
Scrapers and Mechanical Loaders	127,371.40	.127	63,298.07	.087
Tramming Equipment	60,672.81	.061	34,751.34	.048
Pumping Machinery	13,979.43	.014	31,227.58	.043
Total Undg. Costs	2,344,414.18	2.342	1,386,562.40	1.900
Hoisting	86,415.36	.086	65,212.83	.089
Stocking Ore	30,647.38	.031	23,530.33	.032
Dry House	38,853.62	.039	26,652.38	.037
General Surface Expense	25,320.34	.025	28,554.32	.039
Maint. Hoisting Equipment	35,816.20	.036	31,332.16	.043
Shaft	7,789.51	.008	1,661.51	.002
Top Tram Equipment	28,471.16	.028	10,034.99	.014
Docks, Trestles & Pockets	5,130.24	.005	16,927.98	.023
Mine Buildings	14,807.29	.015	4,014.64	.006
Total Surface Costs	273,251.10	.273	207,921.14	.285
Geological	4,941.81	.005	3,648.79	.005
Mining Engineering	25,924.16	.027	19,637.90	.027
Mechanical & Elect. Engrg.	7,087.99	.007	3,987.57	.005
Analysis & Grading	52,144.73	.052	36,738.98	.051
Safety Department	4,252.36	.004	3,240.69	.004
Telephones & Safety Devices	22,098.97	.022	11,665.26	.016
Local & General Welfare	7,239.90	.007	5,148.13	.007
Spec. Exp. Pensions & Allow.	14,119.02	.014	9,165.69	.013
Ishpeming Office	47,338.28	.047	28,459.21	.039
Mine Office	59,186.08	.060	44,633.88	.061
Insurance	28,960.30	.029	13,569.05	.019
Personal Injury	40,445.94	.040	36,696.45	.050
Social Security Taxes	46,391.08	.046	28,598.10	.039
Employees Vacation Pay	49,397.76	.049	35,113.20	.048
Total Gen. Mine Expenses	409,528.38	.409	280,302.90	.384
COST OF PRODUCTION	3,027,193.66	3.024	1,874,786.44	2.569

MATHER MINE "A" SHAFT
ANNUAL REPORT
YEAR 1948

8. COST OF OPERATING (Continued)

Charges Distributed by Mine Office:

	1948		1947	
	Amount	Per Ton	Amount	Per Ton
General & Electrical Supplies	160,779.99	.161	102,901.33	.141
Iron and Steel	105,778.86	.106	42,080.46	.058
Oil and Grease	8,459.94	.008	6,286.49	.008
Machinery Supplies	131,910.24	.132	54,694.47	.075
Explosives	94,691.81	.095	58,976.95	.081
Lumber and Timber	134,595.47	.134	83,362.41	.114
Fuel	12,339.29	.012	6,463.94	.009
Electric Power	138,388.32	.138	120,123.87	.165
Other Items of Expense	29,076.90	.029	12,723.50	.018
Rental	2,245.78	.002	2,388.16	.003
Total	818,266.60	.817	490,001.58	.672

MATHER MINE "A" SHAFT
ANNUAL REPORT
YEAR 1948

8. COST OF OPENING, EQUIPPING, & DEVELOPING:

Capital account expenditures for the year amounted to $828,463.31, which brought the total at the end of 1948 to $5,520,408.91. This total figure does not include an additional $318,223.11 charged in a prior year to Negaunee Mine Company "Idle Expense". The inclusion of this amount brings the grand total to date to $5,838,632.02. "General Expense" and "Maintenance" for the past four years have been charged into "Operating".

Of the above expenditures, almost $100,000.00 was charged against operating costs during the year and, in addition, the several depreciation accounts aggregated $193,716.02. A breakdown of these charges is shown below:

E&A NM-21.....	$ 3,109.08	- Charged to "Exploring in Mine"*
E&A NM-56.....	24,267.21	- Charged to "Cave-in"
E&A NM-61.....	54,750.48	- Charged to "Cave-in"
E&A NM-62.....	16,170.82	- Charged to "Maintenance of Compressors & Power Drills" and "Maintenance of Scrapers & Mechanical Loaders"
	$ 98,297.59	@ $.098 per ton
Combined Depreciation.....	193,716.02	@ .194 per ton
Total	$292,013.61	@ $.292 per ton

Total Capital Account Charges as Above.....	$828,463.31
Total Charge-Offs.....	292,013.61
Actual Net Increase in Expenditures.....	$536,449.70

* In addition to the amount which was transferred from capital account to "Operating", there was an expenditure of approximately $25,000.00 in long range diamond drilling which normally would have been a capital account item. This was taken up on the cost sheet under "Exploring in Mine" at the rate of $.025 per ton.

MATHER MINE "A" SHAFT
ANNUAL REPORT
YEAR 1948

8. COST OF OPENING, EQUIPPING & DEVELOPING: (Continued)

Main level development, drifting and permanent ventilation connections accounted for approximately $315,000.00, or 38% of the total capital expenditures for the year. This was distributed between the 3rd, 6th and the 6½ Levels, and the new shaft deepening project. The next largest single item was $185,000.00 for mining, scraping and haulage equipment. The balance, slightly in excess of $300,000.00, was distributed as follows: 6th Level pumping plant $50,000.00; extensions to the permanent trestles $75,000.00; drainage well and test holes $80,000.00; timber tunnels and yards $60,000.00; a new crawler crane $12,000.00; completion of the boiler plant $30,000.00 and the completion of the installation of the compressors $8,000.00.

8. COST OF OPENING, EQUIPPING, AND DEVELOPING:

	E&A REFERENCE	TOTAL AUTHORIZED	TOTAL EXPENDITURES TO DEC. 31, 1948 GROSS EXPENDITURES	CREDITS A/C ORE MINED IN DEVELOPMENT	NET EXPENDITURES	UNEXPENDED BALANCE	1948 EXPENDITURES
1. BUILDINGS AND EQUIPMENT:							
a. Main Buildings.....	(10-10&19 10-10&19A)	280,000.00	279,990.27	-	279,990.27	9.73	-
b. Change House & Shop Equip..	10-26	60,000.00	60,000.00	-	60,000.00	-	703.43
c. Initial Shop Equip.....	(10-4/10-4A)	5,732.73	5,732.73	-	5,732.73	-	-
d. One 35 Ton Overhead Crane..	(10-9/10-9A)	8,894.94	8,894.94	-	8,894.94	-	-
e. Temporary Equipment.....	10-18	15,000.00	14,079.62	-	14,079.62	920.38	-
f. Erecting & Equipping Storage Building.....	31	20,900.00	20,900.00	-	20,900.00	-	-
g. Compressor Plant.....	10-23/47	131,600.00	135,532.61	-	135,532.61	3,932.61	7,857.57
h. Hot Milling Equipment.....	43	2,871.20	2,871.20	-	2,871.20	-	-
i. Steam Boiler and Heating Equipment.....	52	55,000.00	58,958.60	-	58,958.60	3,958.60	32,240.26
TOTAL.....		579,998.87	586,959.97	-	586,959.97	6,961.10	40,801.26
2. SURFACE:							
a. Equipment:							
1. Temporary Surface Plant	10-3	31,130.00	26,506.28	-	26,506.28	4,623.72	-
2. Truck and Tractor.....	10-1	18,575.00	18,289.42	-	18,289.42	285.58	-
3. Electric Shovel.....	18	85,000.00	85,000.00	-	85,000.00	-	-
4. Top Tram Equipment.....	(10-24/10-24A)	46,000.00	43,375.13	-	43,375.13	2,624.87	-
5. Timber Tunnel, Tracks, Pumphouse and Sump....	(10-20/10-20A)	58,000.00	57,867.78	-	57,867.78	132.22	-
6. Timber Tunnel & Yards..	29/29-1	124,800.00	114,575.84	-	114,575.84	10,224.16	60,071.78
7. Mechanical Additions - Headframe.....	32	27,500.00	27,500.00	-	27,500.00	-	-
8. Crawler Crane.....	51	12,000.00	12,000.00	-	12,000.00	-	158.35
9. Four Wheel Drive Truck.	53	7,500.00	7,497.72	-	7,497.72	2.28	-
10. Spare Armature for Hoist Motors & Generator....	49	12,160.00	-	-	-	12,160.00	-
11. Crawler Mounted Crane..	58	12,500.00	11,676.16	-	11,676.16	823.84	11,676.16
12. International 4-ton Truck	64	6,000.00	6,528.66	-	6,528.66	528.66	6,528.66
Total.....		441,165.00	410,816.99	-	410,816.99	30,348.01	78,434.95
b. General:							
1. Diamond Drilling.....	9	81,000.00	80,965.78	-	80,965.78	34.22	-
2. Moving Two Houses.....	10-2	3,458.00	3,458.00	-	3,458.00	-	-
3. Drainage Well.....	10-11/56	36,896.00	28,550.77	-	28,550.77	8,345.23	24,267.21
4. Road Bldg., Paving Parking Lot, etc.....	25	23,760.00	22,474.12	-	22,474.12	1,285.88	5,327.76
5. Surface Test Hole.....	61	50,000.00	54,750.48	-	54,750.48	4,750.48	54,750.48
Total.....		195,114.00	190,199.15	-	190,199.15	4,914.85	84,345.45
TOTAL SURFACE.....		636,279.00	601,016.14	-	601,016.14	35,262.86	162,780.40
3. SHAFT, HEADFRAME AND TRESTLE:							
a. Sinking in Sand.....	(10-15/10-15A)	16,302.44	16,302.44	-	16,302.44	-	-
b. Sinking in Rock (2,870')...	(10-16/10-16A)	440,000.00	435,677.44	2,559.15	433,118.29	6,881.71	-
c. Shaft Sets (2,870').....	(10-5/10-5A)	160,975.45	159,754.21	-	159,754.21	1,221.24	-
d. Headframe Foundation & Ore Trestle.....	(10-21/10-21A)	78,000.00	77,417.73	-	77,417.73	582.27	-
e. Headframe and Trestle.....	(10-7/10-7A)	186,028.83	186,028.83	-	186,028.83	-	-
f. Extensions to Permanent Stockpile Trestles.....	36/42/42-1	145,152.48	139,843.12	-	139,843.12	5,309.36	74,785.64
g. Headframe & Power Ho. Eqpt..	(10-22/10-22A)	225,000.00	224,451.51	-	224,451.51	548.49	-
h. Elec.Equip.for Cage & Sk. Hsts.	10-8	221,783.00	221,783.00	-	221,783.00	-	-
i. 1 Cage Hoist & 1 Skip Hoist.	10-6	143,000.00	143,000.00	-	143,000.00	-	-
j. Elevator for Headframe.....	(10-12/10-12A)	4,853.00	4,853.00	-	4,853.00	-	-
k. Double Deck Cage - Spare....	37	7,000.00	3,134.75	-	3,134.75	3,865.25	-
l. Pinion Brake for Cage Hoist.	45	4,000.00	4,000.00	-	4,000.00	-	152.30
TOTAL SHAFT, HEADFRAME AND TRESTLE.....		1,632,095.20	1,616,246.03	2,559.15	1,613,686.88	18,408.32	74,937.94

8. COST OF OPENING, EQUIPPING AND DEVELOPING:
(Continued)

	E&A REFERENCE	TOTAL AUTHORIZED	TOTAL EXPENDITURES TO DEC. 31, 1948 GROSS EXPENDITURES	CREDITS A/C ORE MINED IN DEVELOPMENT	NET EXPENDITURES	UNEXPENDED BALANCE	1948 EXPENDITURES
4. UNDERGROUND:							
a. Plant:							
1. Pumping - 3rd Level....	10-25/10-25A	55,000.00	53,738.88	-	53,738.88	1,261.12	-
2. Pumping Plant - 6th Level	39	215,600.00	227,684.94	-	227,684.94	12,084.94	48,487.69
Total.....		270,600.00	281,423.82	-	281,423.82	10,823.82	48,487.69
b. Equipment:							
1. Mining Equipment.....	19	44,550.00	44,550.00	-	44,550.00	-	-
2. Mining Equipment.....	28	51,700.00	51,700.00	-	51,700.00	-	2,695.68
3. Mining Equipment.....	40	61,710.00	61,710.00	-	61,710.00	-	-
4. Mining Equipment.....	41	28,050.00	28,050.00	-	28,050.00	-	1,367.20
5. Mining Equipment.....	55	23,870.00	23,870.00	-	23,870.00	-	10,764.75
6. Mining Equipment.....	62	30,000.00	16,170.82	-	16,170.82	13,829.18	16,170.82
7. Mining Equipment.....	65	60,000.00	26,648.50	-	26,648.50	33,351.50	26,648.50
8. Haulage Equipment.....	10-29/10-29A	110,000.00	110,000.00	-	110,000.00	-	2,031.17
9. Haulage Equipment.....	23	90,420.00	89,732.02	-	89,732.02	687.98	1,898.72
10. Haulage Equipment.....	46	84,755.00	85,592.50	-	85,592.50	837.50	17,382.22
11. Haulage Equipment.....	59	46,000.00	44,372.88	-	44,372.88	1,627.12	44,372.88
12. Underground Substations	38	14,300.00	14,300.00	-	14,300.00	-	2,168.26
13. Main Ventilating Fan...	48	24,200.00	17,300.17	-	17,300.17	6,899.83	3,635.87
14. Twelve Scraper Hoists..	50	33,000.00	32,980.80	-	32,980.80	19.20	11,303.20
15. Scraper Hoists.....	54	49,500.00	50,731.98	-	50,731.98	1,231.98	48,161.98
Total.....		752,055.00	697,709.67	-	697,709.67	54,345.33	184,264.73
c. Development:							
1. Main Level Development:							
Plats and Pockets....	(10-28/10-28A 26-26A/27-27A 57/63)	431,600.00	294,083.57	-	294,083.57	137,516.43	76,965.52
Drifting.....	(10-27/24/26-26A-27-27A/33 57/60	1,261,521.20	1,246,106.88	80,404.67	1,165,702.21	95,818.99	221,773.27
Ventilation & 2nd Outlet.....	26-26A/27-27A	53,900.00	36,190.46	-	36,190.46	17,709.54	15,343.42
2. Development & Mining above Levels...	(24/26-26A 27-27A/34)	203,728.80	194,487.12	49,921.83	144,565.29	59,163.51	-
3. Undg. Exploration.....	21	35,000.00	34,838.62	-	34,838.62	161.38	3,109.08
Total.....		1,985,750.00	1,805,706.65	130,326.50	1,675,380.15	310,369.85	317,191.29
d. Dewatering Hematite Workings	30	66,000.00	64,232.28	-	64,232.28	1,767.72	-
TOTAL UNDERGROUND.....		3,074,405.00	2,849,072.42	130,326.50	2,718,745.92	355,659.08	549,943.71
GRAND TOTAL BEFORE CONTINGENCIES		5,922,778.07	5,653,294.56	132,885.65	5,520,408.91	402,369.16	828,463.31
Plus 10% for Contingencies....		228,217.26	-	-	-	228,217.26	-
GRAND TOTAL INCLUDING CONTINGENCIES		6,150,995.33	5,653,294.56	132,885.65	5,520,408.91	630,586.42	828,463.31
General Expense.....	10-13	-	271,716.98	-	271,716.98)	-	1948 Expense
Maintenance.....	10-14	-	37,050.73	-	37,050.73)	-	taken up in "Cost
Building Roads & Landscaping	10-17	-	9,455.40	-	9,455.40)	-	of Operating"
Total to Negaunee Mine Company Idle Expense.....		-	318,223.11	-	318,223.11	-	
GRAND TOTAL.....		6,150,995.33	5,971,517.67	132,885.65	5,838,632.02	630,586.42	828,463.31

MATHER MINE "A" SHAFT
ANNUAL REPORT
YEAR 1948

8. COST OF OPENING, EQUIPPING & DEVELOPING: (Continued)

With the exception of a small amount of drifting on the 3rd Level in the completion of the "Cambria Connection", main level drifting was confined to the 3rd and 6th Levels under E&A's NM-60 and 27A. With the exception of a short piece on the 3rd Level, all of the new drift was supported with either timber or steel. In addition to the 67' of untimbered rock drift, the following table includes 1,488' of timbered drift on the 3rd and 3,849' of drift on the 6th, part of which was supported with timber and the balance with steel. In addition to the footage in the table, there were 1,037' of timbered ore drift (413' on the 3rd and 624' on the 6th), the cost of which was taken up on the operating cost sheet under "Development in Ore".

	Actual Per Foot	Timbering Supplies & Labor Per Foot	Total Per Foot	Distributive Charges Per Foot	Grand Total Per Foot	1947 Grand Total Per Foot - 4,536'
Untimbered Rock Drift - 67'.....	23.35	-	23.35	4.35	27.70	-
Timbered Rock Drift - 5,337'..	29.10	5.65	34.75	4.93	39.68	43.60

The increased efficiency of new drifting methods had the effect of reducing the average cost per foot for timbered rock drift from $43.60 to $39.68. This was accomplished in spite of an increase in labor and supply costs of approximately 10%. The new equipment which played a large part in this increased efficiency includes a hydraulically operated jumbo and new 3" drifters with 8' feeds, purchased from the Sullivan Division of the Joy Manufacturing Company. The other important change was the use of tungsten carbide insert bits, which permit the drilling of an 8' hole with a single rod without loss of gage.

MATHER MINE "A" SHAFT
ANNUAL REPORT
YEAR 1948

9. EXPLORATIONS AND FUTURE EXPLORATIONS

There was no surface exploration as such in Section 2 during the year, except for the testing already described under 6 (f) "Surface Drainage".

Underground drilling consisted of work in fifteen holes (#43 to #59 inclusive), three on the 3rd Level, one on the theoretical 4th Level elevation, three on the 5th and eight on the 6th. #43, #45 and #48 were started the previous year and completed early in 1948. All of the others were started and completed during the year.

3rd Level:
Hole #45 was continued from a depth of 286' on the 1st of the year, and completed at 567'. This hole disclosed what looked like an extensive and important deposit, in that it intercepted 122' of ore divided into two runs by a seam of jasper. This exploration served as a basis for the planning and driving of the new south footwall drift. Subsequently, D.D.H. #57 was drilled from the south end of #5 Cross-cut, encountering two short runs of high grade sulphurous ore south of the original find and considerably below the level. The findings in this hole indicated that the ore body is not continuous and not nearly as extensive as was originally hoped.

Hole #58 was put in to the south from the new south footwall drift approximately 200' east of #57. This hole encountered no ore and further limited the extent of the deposit. All of the reserves found during the year by diamond drilling, main level drifting and sub-level exploration work were quite high in sulphur, although well within the limit of mixing for the new "Mine Run" grade.

-435' Sub
Hole #48 was put in to the southwest from the exploration drift at this elevation to further augment the information obtained in 1947. This hole outlined a small amount of sulphurous ore and located the contact with the main dike. Information obtained to date in this deposit, which is vertically under #7 Cross-cut on the 3rd and above #7 Cross-cut on the 5th, indicates an upward pitch to the east and a downward trend toward the west, where it probably joins with the new deposit found much further to the west on the 3rd Level.

MATHER MINE "A" SHAFT
ANNUAL REPORT
YEAR 1948

9. EXPLORATIONS AND FUTURE EXPLORATIONS (Continued)

5th Level:
Hole #43 was continued from a depth of 504' and completed to a depth of 906' south of #9 Cross-cut. This hole proved that the interbedded horizon is unenriched in this area, and that no concentration exists beyond and above the interbedded slate. Later, Hole #51 was put in to the southeast from the same location and merely served to prove the information obtained in #43. Unless more favorable information is ultimately obtained, this rules out any possibility of sufficient reserves to warrant the driving of #8, #9 or #10 Cross-cuts on this level.

Hole #49 was put in a short distance southwest of the end of #1 Cross-cut in an attempt to locate the mixed deposit shown up by the cross-cut. The attempt was unsuccessful and the hole was stopped at a depth of 184' in capping jasper.

6th Level:
Hole #50 was put in from the end of the uncompleted Cross-cut #5 and disclosed 90' of Standard ore, which warranted continuing the cross-cut into the jasper beyond it. The hole was put in to the south through the ore and stopped in jasper at a depth of 245'.

Hole #52 was put in from the end of #6 Cross-cut a short distance beyond the P.T. Except for encountering the interbedded ore in its normal position, the hole was in soft ore jasper for a distance of almost 300' beyond the interbedded slate. It proved that there was no ore which would warrant the continuation of this cross-cut.

Hole #53 was put in to the south from the uncompleted heading in #7 Cross-cut just beyond the P.T. This hole located the interbedded ore in the normal position and was abandoned at a depth of 331' due to caving. Hole #53-"A" was wedged off from #53 at a depth of 224' and continued to the south through jasper, where it was stopped at a distance of 637'.This hole disclosed two runs of high grade Standard ore and one which was somewhat higher in sulphur, and indicated the desirability of continuing the cross-cut. This indication was later proved by the information obtained in Hole #54, which was put in from the same location to the southeast at a dip of +10°. The interbedded ore was present in the normal position and the hole was continued to a depth of 403', beyond #8 Dike, where a long, important run of high grade ore was encountered. In the aggregate, this ore extended almost 200' in two runs separated by a small dike. The exact relationship of this deposit to other known deposits has not yet been thoroughly determined.

MATHER MINE "A" SHAFT
ANNUAL REPORT
YEAR 1948

9. EXPLORATIONS AND FUTURE EXPLORATIONS (Continued)

6th Level: (Continued)
Hole #55 was put in due south from a small cut-out in #8 Cross-cut approximately 100' south of the main footwall drift. Except for the interbedded ore, this hole disclosed no enrichment to a depth of 687', where it was stopped in jasper beyond #9 Dike.

Hole #56 was put in from the south end of #8 Cross-cut, starting a few feet south of the interbedded ore. This hole, which was drilled well into the jasper beyond #9 Dike, was stopped at a depth of 399' without encountering any enrichment.

Hole #59 was put in at a dip of +45° from approximately the same location as #55. This attempt to locate a continuation of the reserves found in Hole #54 was not successful and the hole was stopped in jasper at a depth of 275', where it had almost reached the 5th Level elevation. A considerable amount of additional exploration will undoubtedly be required before the relationship of this deposit is established. Conceivably, it could be a continuation of the deposit found by drilling to the southeast from the ends of #7 Cross-cuts on the 2nd and 3rd Levels.

MATHER MINE "A" SHAFT EXPLORATION
YEAR 1948

NO.	LOCATION	DIRECTION	DIP	DATE STARTED	DATE FINISHED	MATERIAL		FINISHED DEPTH
43	5th Level (2050') #9 Cross-cut	S. 1°38'E	+2°52'	11/3/47	2/28/48	504 - 528' 528 - 534' 534 - 645' 645 - 653' 653 - 828' 828 - 837' 837 - 906'	Soft Ore Jasper Dike Soft Ore Jasper Dike Soft Ore Jasper Sulphurous Lean Ore Soft Ore Jasper	906'
45	3rd Level (1750')	S. 0°41'W	+3°26'	11/12/47	2/2/48	286 - 383' 383 - 386' 386 - 434' 434 - 445' 445 - 508' 508 - 515' 515 - 567'	Transition Jasper & Slate Soft Ore Jasper Sulphurous Ore Soft Ore Jasper Sulphurous Ore Sulphurous Lean Ore Soft Ore Jasper	567'
48	-435' Sub-level	S. 32°15'W	+4°05'	12/29/47	1/16/48	60 - 75' 75 - 85' 85 - 95' 95 - 100' 100 - 110' 110 - 115' 115 - 175' 175 - 245' 245 - 252' 252 - 265' 265 - 290'	Soft Ore Jasper Sulphurous Lean Ore Sulphurous Ore Sulphurous Lean Ore Sulphurous Ore Sulphurous Lean Ore Sulphurous Ore Dike Soft Ore Jasper Sulphurous Ore Soft Ore Jasper	290'

MATHER MINE "A" SHAFT EXPLORATION
YEAR 1948

NO.	LOCATION	DIRECTION	DIP	DATE STARTED	DATE FINISHED	MATERIAL		FINISHED DEPTH
49	5th Level (2050') #1 Cross-cut	S. 27°04'W	+2°02'	1/12/48	2/21/48	0 - 40' 40 - 51' 51 - 85' 85 - 123' 123 - 126' 126 - 184'	Slate Transition Slate & Jasper Transition Jasper & Slate Soft Ore Jasper Slate Soft Ore Jasper	184'
50	6th Level (2200') #5 Cross-cut	S.1° 12'E	+1°04'	2/7/48	2/28/48	0 - 40' 40 - 132' 132 - 245'	Soft Ore Jasper Standard Ore Soft Ore Jasper	245'
51	5th Level (2050') #9 Cross-cut	S.30°21'E	+0°50'	3/2/48	4/9/48	0 - 170' 170 - 177' 177 - 202' 202 - 204' 204 - 227' 227 - 230' 230 - 256' 256 - 334' 334 - 412' 412 - 424' 424 - 431' 431 - 720'	Slate Dike Slate Transition Jasper & Slate Soft Ore Jasper Standard Ore Soft Ore Jasper Slate Transition Jasper & Slate Soft Ore Jasper Dike Soft Ore Jasper	720'
52	6th Level (2200') #6 Cross-cut	S.0°46'E	+1°01'	4/9/48	5/7/48	0 - 36' 36 - 40' 40 - 119' 119 - 125' 125 - 176' 176 - 216' 216 - 239' 239 - 350' 350 - 613'	Slate & Graywacke Dike Slate Dike Slate Standard Ore Slate Transition Jasper & Slate Soft Ore Jasper	613'

MATHER MINE "A" SHAFT EXPLORATION
YEAR 1948

NO.	LOCATION	DIRECTION	DIP	DATE STARTED	DATE FINISHED	MATERIAL		FINISHED DEPTH
53	6th Level (2200') #7 Cross-cut	S.0°32'E	+0°46'	5/18/48	6/8/48	0 - 177'	Slate & Graywacke	331'
						177 - 215'	Standard Ore	
						215 - 219'	Lean Ore	
						219 - 268'	Slate	
						268 - 309'	Transition Slate & Jasper	
						309 - 331'	Transition Jasper & Slate	
						Hole #53 was abandoned at 331' and Hole #53-"A" was wedged off at 224'.		
53-"A"	6th Level (2200') #7 Cross-cut	S.1°E	+2°	6/10/48	7/19/48	224 - 263'	Slate	637'
						263 - 275'	Transition Slate & Jasper	
						275 - 284'	Transition Jasper & Slate	
						284 - 338'	Soft Ore Jasper	
						338 - 360'	Sulphurous Ore	
						360 - 370'	Lean Ore	
						370 - 524'	Soft Ore Jasper	
						524 - 534'	Dike	
						534 - 540'	Lean Ore	
						540 - 571'	Standard Ore	
						571 - 581'	Soft Ore Jasper	
						581 - 586'	Standard Ore	
						586 - 637'	Soft Ore Jasper	

MATHER MINE "A" SHAFT EXPLORATION
YEAR 1948

NO.	LOCATION	DIRECTION	DIP	DATE STARTED	DATE FINISHED	MATERIAL		FINISHED DEPTH
54	6th Level (2200') #7 Cross-cut	S.30°31'E	+10°13'	7/21/48	8/30/48	0 - 160'	Slate	664'
						160 - 170'	Transition Jasper & Slate	
						170 - 192'	Standard Ore	
						192 - 212'	Soft Ore Jasper	
						212 - 289'	Slate	
						289 - 332'	Transition Jasper & Slate	
						332 - 336'	Dike	
						336 - 365'	Soft Ore Jasper	
						365 - 370'	Dike	
						370 - 378'	Soft Ore Jasper	
						378 - 391'	Dike #8	
						391 - 403'	Soft Ore Jasper	
						403 - 478'	Standard Ore	
						478 - 481'	Dike	
						481 - 600'	Standard Ore	
						600 - 664'	Soft Ore Jasper	
55	6th Level (2200') #8 Cross-cut	S.0°56'E	+0°58'	7/29/48	10/6/48	0 - 134'	Slate	687'
						134 - 162'	Standard Ore	
						162 - 175'	Slate	
						175 - 180'	Dike	
						180 - 212'	Slate	
						212 - 295'	Transition Jasper & Slate	
						295 - 389'	Soft Ore Jasper	
						389 - 394'	Lean Ore	
						394 - 400'	Dike	
						400 - 416'	Lean Ore	
						416 - 673'	Soft Ore Jasper	
						673 - 682'	Dike #9	
						682 - 687'	Soft Ore Jasper	

MATHER MINE "A" SHAFT EXPLORATION
YEAR 1948

NO.	LOCATION	DIRECTION	DIP	DATE STARTED	DATE FINISHED	MATERIAL		FINISHED DEPTH
56	6th Level (2200') #8 Cross-cut	S.1°17'E	+1°37'	9/1/48	9/20/48	0 - 29' 29 - 145' 145 - 274' 274 - 291' 291 - 399'	Slate Transition Jasper & Slate Soft Ore Jasper Dike #9 Soft Ore Jasper	399'
57	3rd Level (1750') #5 Cross-cut	S. 0°51'E	-24°39'	9/22/48	10/7/48	0 - 75' 75 - 92' 92 - 257' 257 - 260' 260 - 262' 262 - 277 277 - 286' 286 - 331'	Soft Ore Jasper Sulphurous Ore Soft Ore Jasper Sulphurous Lean Ore Sulphurous Ore Soft Ore Jasper Dike #5 Soft Ore Jasper	331'
58	3rd Level (1750')	S.0°25'E	+1°	10/21/48	11/12/48	0 - 330' 330 - 332' 332 - 354'	Soft Ore Jasper Dike #5 Soft Ore Jasper	354'
59	6th Level (2200') #8 Cross-cut	S. 1°03'E	+45°	10/22/48	11/23/48	0 - 85' 85 - 111' 111 - 148' 148 - 223' 223 - 275'	Slate Soft Ore Jasper Slate Transition Slate & Jasper Transition Jasper & Slate	275'

MATHER MINE "A" SHAFT
ANNUAL REPORT
YEAR 1948

9. EXPLORATIONS AND FUTURE EXPLORATIONS (Continued)

There was a sharp increase in the cost per foot for underground diamond drilling, and the total expended under the account "Exploring in Mine". However, the increased production practically offset the increased amount expended, with the result that the cost per ton for the year was $.038 as compared with $.034. The cost per foot for diamond drill supplies is readily explained by the sharp increase in the purchase prices of drill bits, which in some cases were increased as much as 150%. The increase in labor is partially explained by the general wage increase. The remainder of this increase is due to the fact that a large percentage of the drilling was done in holes which were appreciably deeper than in the previous year.

	1948 Expenditures	Cost Per Foot	Cost Per Foot 1947
Equipment:	$ 580.00	-	-
Drilling Costs:			
Labor	$14,851.59	$2.423	$1.756
Miscellaneous Supplies & Diamond Drill Carbon.....	15,374.37	2.509	1.571
Diamond Drill Rental.....	694.88	.113	.108
Total.....	$30,920.84	$5.045	$3.435
Overhead Expense:			
Analysis.....	$ 704.12	$ .115	$ .108
Geological.....	1,528.29	.249	.164
D.D. Supt.....	726.81	.119	.105
Auto Mileage.....	80.09	.013	.003
Total.....	$ 3,039.31	$ .496	$ .380
GRAND TOTAL.....	$34,540.15	$5.541	$3.815

MATHER MINE "A" SHAFT
ANNUAL REPORT
YEAR 1948

10. TAXES:

The taxes for both Section 2 (Mather Mine "A" Shaft) and Section 1 (Mather Mine "B" Shaft) were taken up on the "A" Shaft operating cost sheet. The valuations of Section 2, both real and personal, were sharply increased in the amount of $660,000.00. In addition, a special election increased the tax rate for school purposes four mills over that for the previous year. The result was an increase in the amount for taxes of approximately $37,000.00. In Section 1, the increase in valuation was substantial, in the amount of $145,000.00 above the previous figure of $550,000.00, with an increase in the amount for taxes of approximately $6,500.00. As usual, the rate in Negaunee is much higher than in Ishpeming.

	1948			1947		
	VALUATION	RATE	TAXES	VALUATION	RATE	TAXES
Section 2, 47-27, except the N 600' of NE of NE and the Rights of Way						
Real	$2,125,000		$ 84,435.60	$1,875,000		$ 67,137.56
Personal	1,175,000		46,687.92	765,000		27,392.13
Total	$3,300,000	$39.7344	$131,123.52	$2,640,000	$35.8067	$ 94,529.69
Coll. Fee	-	-	-	-	-	-
Total	$3,300,000	$39.7344	$131,123.52	$2,640,000	$35.8067	$ 94,529.69
Mather Mine Pipe Line, parcel in Section 3, 47-27	$ 250	$39.7344	$ 9.93	$ 250	$35.8067	$ 8.95
Total Mather Mine "A" Shaft (Sec. 2, City of Ishpeming)	$3,300,250	$39.7344	$131,133.45	$2,640,250	$35.8067	$ 94,538.64
Jackson, Section 1, 47-27						
Real	$ 550,000		$ 24,373.42	$ 550,000		$ 24,346.52
Personal	145,000		6,425.72	-		-
Total	$ 695,000	$44.3153	$ 30,799.14	$ 550,000	$44.2664	$ 24,346.52
Coll. Fee 1%	"	.4432	307.99	"	.4427	243.46
Total Mather Mine "B" Shaft (Sec. 1, City of Negaunee)	$ 695,000	$44.7585	$ 31,107.13	$ 550,000	$44.7091	$ 24,589.98
GRAND TOTAL	$3,995,250		$162,240.58	$3,190,250		$119,128.62

The increase in production and shipments almost exactly offsets the increase in valuations and rates.

	1948		1947	
	Tons	Per Ton	Tons	Per Ton
Taxes per Ton Produced	1,001,001	$0.162	729,669	$0.163
Taxes per Ton Shipped	990,757	$0.164	710,275	$0.168

MATHER MINE "A" SHAFT
ANNUAL REPORT
YEAR 1948

11. ACCIDENTS AND PERSONAL INJURY:

There were 36 compensible injuries during the year, which occasioned lost time of 896 days, and one fatality which added 6,525 statistical days, for a total of 7,421. There were also 65 non-compensible injuries, which added 163 days lost time, for a grand total of 7,584. This resulted in a severity rate of 5.749 days lost per thousand man hours, and a frequency rate of 76.57 injuries per million man hours, compared with Company averages for underground mines of 5.027 and 56.88. The total hours worked were 1,319,265¼ as compared with 968,519 last year, an increase of approximately 36%. The following is a brief summary of the compensible accidents:

DATE	NAME	NATURE OF INJURY
1/12/48	Gordon LaMere	Minor bruises and slight fracture of the head of left humerus.
1/14/48	Willis J. LaForest	Fatally injured.
1/20/48	Lee Magnuson	Severe contusion of left hip and back.
2/28/48	Samuel Sapila	Severe contusion in the muscles of left thigh.
3/18/48	Waino Mutka	Lumbo-sacral strain.
4/8/48	Ellsworth LaBeau	Amputation of tips of two fingers of left hand.
4/9/48	Leo McGlone	Laceration of the right foot.
4/22/48	Arthur Seablom	Probable fracture of the transverse process of the 2nd lumbar vertebra.
4/29/48	Henry Poutanen	Fracture of the 4th finger of right hand.
4/30/48	Carl Kestila	Abrasions of right thigh, hip and chest.
4/30/48	Lee Magnuson	Superficial lacerations and contusions of right foot.
5/15/48	Henry Kiiskila	Fracture of 2nd metatarsal of left foot.
5/21/48	Gerald Champion	Severe contusion of right hand.
5/22/48	Lawrence Gaboury	Muscle strain of the abdomen and back.
5/28/48	Paul Helgren	Fractured nose. (Compensible, but no lost-time)
7/10/48	Vito Roti	Fracture of right scapula.
7/20/48	William Kyrola	Fracture of left clavicle.
7/27/48	William Polkinghorne	Contusion left eyeball.
7/28/48	Leo Antilla	Contusion and swelling of left leg.
8/11/48	Leslie Burnette	Fracture of index finger right hand.
8/11/48	Reuben Kjellman	Fracture of tip of 2nd finger left hand.
8/21/48	Alfred Beadle	Sprained muscles left lower side.

MATHER MINE "A" SHAFT
ANNUAL REPORT
YEAR 1948

11. ACCIDENTS AND PERSONAL INJURY: (Continued)

DATE	NAME	NATURE OF INJURY
8/23/48	Edwin Tuoriniemi	Phlebothrombosis both legs.
9/9/48	Frank Hiissala	Severe contusion of tip of 4th finger left hand.
9/10/48	Elzy Corkin	Fracture of lower end of left radius.
9/13/48	George Koski	Contusion of right foot.
9/30/48	Eli Pyykola	Fracture in first joint of left thumb.
10/4/48	Urho Oja	Deep puncture wound in left foot.
10/8/48	David Champion	Dislocated left knee.
10/16/48	John E. Olson	Contusion of the left side.
10/21/48	Alger Bengson	Contusions of the middle back region, an incomplete fracture of the little toe of right foot and a sprain of left foot.
11/3/48	Ole Olson	Laceration left leg below knee.
11/3/48	Louis Delliss	Severe contusion and bruise of left forearm.
11/8/48	John McVannel	Amputation of first joint 3rd finger right hand.
12/2/48	Peter Denofre	Fracture first phalanx 2nd toe left foot.
12/6/48	Emmett Hoiem	Contusion of left foot.
12/8/48	Thomas Collins	Fracture distal 1/3 fibula, left. Fracture distal 1/3 tibia, left posterior.

12. NEW CONSTRUCTION AND PROPOSED NEW CONSTRUCTION:

The major items of new construction have already been discussed under 6 "Surface". These include the continued work in the east timber tunnel and yard, the completion of the extensions to the permanent trestles and the construction of a new front entrance to the plant.

The only new construction planned for 1949 is: additional and final extensions to the permanent trestles, including double tracking the approaches to the trestles, and the installation of new permanent stockpile loading tracks by the Lake Superior & Ishpeming Railroad Company.

MATHER MINE "A" SHAFT
ANNUAL REPORT
YEAR 1948

13. EQUIPMENT AND PROPOSED EQUIPMENT:

There was a considerable amount of new equipment purchased during the year for both surface and underground use. The major items on surface were:

(1) One Hyster D-8 tractor yarder. This equipment was installed on the D-8 Caterpillar tractor for the primary purpose of scraping stocked ore beyond the ends of the permanent trestles. It also has several important secondary uses, including heavy erecting and hauling on surface.

(2) One 15-B Bucyrus-Erie gasoline-driven crawler crane. This is the second unit of this size and was purchased to replace the original 10-B, which had proved too small for the work required of it. The two machines are kept busy, largely handling material in the timber yards.

(3) One International 4-ton platform body dump truck. This unit replaced the original 5-ton truck, which was eight years old.

(4) One wood grapple. This equipment was purchased for use with the second 15-B crane. These grapples have proved invaluable in efficient, economical handling of timbering supplies.

(5) Two 300 ampere Wilson Hornet stationary welding machines.

(6) Two Lombard electric chain saws.

(7) One Oxweld portable cutting machine.

(8) One portable Hi-pressure Jenny steam cleaner.

The major additions to the underground equipment are listed below:

(1) One Sullivan-Joy 3-machine Hydro-air Jumbo drill rig, known as the "Hydro Drill Jib".

(2) One 2-unit pneumatic car dumper.

(3) Twelve 100 cubic foot "Lohed" underground Lake Shore cars.

(4) Four General Electric battery locomotives and five spare batteries.

(5) Twelve Coppus Ventair blowers.

(6) One Worthington 4-7/8" x 18" horizontal Duplex double-acting plunger pump, 500 G.P.M. This is the third such pump installed in the 6th Level pumping plant.

MATHER MINE "A" SHAFT
ANNUAL REPORT
YEAR 1948

13. EQUIPMENT AND PROPOSED EQUIPMENT: (Continued)

In addition to the above, there was a large amount of miscellaneous mining equipment purchased, including air and electric hoists both single and double drum, and miscellaneous drill machines and scraping equipment. The two new types of equipment were the Joy "Hydro Jib" and the Le Roi-Cleveland 3" reverse feed air stopers, both previously discussed.

On order for delivery next year is a Model 40 Hydro-electric Eimco shovel and two 125 H.P. motor RF-211 scraper hoists from the Sullivan-Joy Manufacturing Company. The much discussed replacements for the present top tram larry cars were studied at considerable length throughout the year. By the end of the year, the final design was rapidly nearing completion, the work being done by the Design Service Company of Cleveland, Ohio. An authorization for this new equipment will probably be requested in 1949.

14. MAINTENANCE AND REPAIRS:

Another large job was done on the permanent trestles just east of the headframe, the cost of which was charged to "Maintenance of Docks, Trestles and Pockets". This work involved an extensive revision of the track layout and occasioned a large amount of work in making the necessary changes to the structural members. The design for the changes and the detailing of the shop work was done by our Consulting Engineer, Mr. Ralph Boeck of Milwaukee, Wisconsin; and the work was fabricated in the Company's General Shops and erected by the Company's steel erection crew. The work was done in advance of erecting the double track approaches, on schedule for the coming year.

The usual heavy maintenance and repair program was continued with the top tram larry cars to the point where it was necessary to almost completely overhaul all three units, which work was rapidly nearing completion by the end of the year. Meanwhile, stocking was done by the use of the Euclid trucks rented from the Tilden Mine.

The third Conway Model 125 underground loader was overhauled, with the result that maintenance and repairs were not quite as heavy as in the previous year. Two of the three machines were in almost constant use, with the third as a standby unit.

MATHER MINE "A" SHAFT
ANNUAL REPORT
YEAR 1948

14. MAINTENANCE AND REPAIRS: (Continued)

The Caterpillar D-8 tractor, which is now eight years old, will be sent to the manufacturer's maintenance garage in Marquette for a complete overhauling. Basically, the machine is still in excellent condition.

As has been previously discussed at some length, a large program of maintenance and repairs was carried on throughout the entire year in the permanent underground haulage drifts. In general, this work consisted of replacing the wood sets with steel sets of our own design, and replacing the wood carrying poles with reinforced concrete slabs. In and around the shaft plats, all wood is being replaced by concrete and steel. This work will be carried on throughout at least the forthcoming year.

15. POWER:

	CONSUMPTION K.W. HOURS	AVERAGE MAX. DEMAND	AVERAGE DEM. FACTOR	COST OF CURRENT	AVERAGE PRICE PER K.W. HOUR
1948 -	11,217,000	2,355 K.W.	54%	$155,508.80	$0.0139
1947 -	10,059,000	2,160 K.W.	53%	140,078.60	.0139
1946 -	5,570,000	1,530 K.W.	48%	80,677.20	.0144
1945 -	4,720,000	1,245 K.W.	43%	69,566.20	.0148
1944 -	3,893,000	965 K.W.	46%	56,121.80	.0144
1943 -	2,785,000	600 K.W.	48%	39,725.80	.0142
1942 -	1,510,830	325 K.W.	47%	23,448.14	.0155

In line with the increasing operation, there was another sharp increase in both the total consumption and the average maximum demand. The power factor was increased slightly from 53% to 54%, without any change in the average price per kilowatt hour of $.0139. As was mentioned under 2 (g) "Operating Delays", there was a general shortage of hydro-electric power throughout the area, with the result that numerous plans for saving power were put into effect.

MATHER MINE "A" SHAFT
ANNUAL REPORT
YEAR 1948

16. WATER SUPPLY:

	CONSUMPTION	COST	COST PER THOUSAND GAL.
1948 -	20,068,100	$1,662.64	$ 0.082
1947 -	17,241,600	1,436.52	.083
1946 -	10,620,100	928.41	.086
1945 -	7,628,800	710.71	.093
1944 -	5,205,200	481.82	.092
1943 -	4,868,000	446.64	.092
1942 -	2,487,000	231.36	.093

The substantial increase in the consumption of water was not as great as it would have been had more City water been available. Toward the end of the summer, the lawn sprinklers were used very little, and the plan to put City water underground was not put into effect. The amount of water available for underground use on the 960' Level was nearly exhausted several times during the year, and it will probably be necessary to use City water in spite of the shortage. The piping for this purpose was partly installed by the end of the year.

18. NATIONALITY OF EMPLOYEES:

	American Born	Per Cent	Foreign Born	Per Cent	Total	Per Cent
American	16	2.4%	-	-	16	2.4%
English	90	14.0	14	2.2	104	16.2
Finnish	217	33.7	25	3.9	242	37.6
Canadian	28	4.3	1	.2	29	4.5
Swedish	58	9.0	4	.6	62	9.6
Norwegian	21	3.3	-	-	21	3.3
German	19	3.0	-	-	19	3.0
Irish	12	1.9	-	-	12	1.9
Danish	1	.2	-	-	1	.2
Italian	48	7.4	14	2.2	62	9.6
French	54	8.4	-	-	54	8.4
Manx	1	.2	-	-	1	.2
Dutch	3	.5	-	-	3	.5
Austrian	8	1.2	2	.3	10	1.5
Polish	3	.5	-	-	3	.5
Belgian	4	.6	-	-	4	.6
	583	90.6%	60	9.4%	643	100.0%

MORRIS MINE
ANNUAL REPORT
YEAR 1948

1. GENERAL

Production and shipments from the Morris Mine increased for the third successive year to normal figures for the 5½ day per week schedule worked in 1948. The sub level stoping system of mining was employed where possible, and this combined with extended use of the sub level caving system to increase the average daily product and the efficiency therefore of the mine as a whole.

The single Morris Grade, a combination of the former standard and silica grades, was produced in 1948 with an average iron content of nearly 56% dry, and a silica of 12.28%. This showed some increase in dilution from the 56.87% iron content of the ore shipped the year previous, but was more than offset by the lower cost of the mining system changes which resulted in increased production. The ore reserve position was well maintained by underground development and the estimate in round figures showed 4,040,000 tons compared to 4,100,000 tons on December 31st, 1947, or in other words, replacement of all but 60,000 tons of the 348,633 tons mined in 1948. The new ore, however, was developed on Chase Lease #9 and #24 and there was no replacement of reserves on the fee lands in 1948. This was due largely to mining progressing from development accomplished in 1946 and 1947 on the fee lands.

Diversion of the Carp River and mine water discharge in the new ditch northeasterly directly to the Deer Lake storage basin was made experimentally in August, and after repairs to the dikes forming the settling basin for the mine discharge lasting into September, the diversion was expected to be continued indefinitely from that time forward. The settling out of solids and coloring from the mine water was successful beyond expectations, and the removal of the Carp River hazard from over the 9th Level mining area was therefore accomplished without possibility of complaint from property owners along and beyond the route of the new diversion channel. The average pumping rate from the deep wells in surface material over the ore bodies increased from 1622 gpm in 1947 to 1847 gpm in 1948 and the underground pumping rate for the fourth successive year showed an increase, the 1947 and 1948 averages amounting to 969.4 gpm and 1076.6 gpm respectively.

2. PRODUCTION SHIPMENTS & INVENTORIES

A. Production

Grade	Tons
Morris	348,633
Total last year	267,236

MORRIS MINE
ANNUAL REPORT
YEAR 1948

2. PRODUCTION
SHIPMENTS &
INVENTORIES (cont.)

The 1948 production came from fee and leased lands in the following proportions:

Grade	Fee	Leased	Total
Morris	90,591	258,042	348,633
Percentage	26	74	100

The percentage of ore from the Fee lands compares with 29.2% in 1947. The maximum proportion of ore from the Fee lands was 48.1% in 1936 and the minimum 11.4% in 1941.

A summary of fee and leased total production since the Inland Steel Company acquired the Morris Mine lease, starting with 1933 or over a sixteen year period, is listed below:

	Tons	Percent
Leased ore produced 1933-1948	3,548,991	75.16
Fee ore produced 1933-1948	1,172,782	24.84
Total	4,721,773	100.00%

b. Shipments

Shipments of ore from the Morris Mine reached a high of 442,199 tons in 1943. This was followed by a decrease in each of the next three years but the trend started upward again in 1947 and continued through 1948. The 1948 shipments are the largest since 1943 and the total was divided as follows:

Grade	Pocket	Stockpile	Total
Morris	230,683	116,451	347,134

Grade	Fee	Lease	Total
Morris	91,330	255,804	347,134

A table showing shipments from the mine in each of the past five years follows:

Year	Grade		Total
1948	Morris		347,134
1947	Morris		278,916
	Standard	Silicious	
1946	142,157	39,850	182,007
1945	175,688	69,480	245,168
1944	236,764	83,169	319,933

A summary of shipments since Inland acquired the lease shows a total of 4,694,712 tons.

MORRIS MINE
ANNUAL REPORT
YEAR 1948

c. Ore in Stock

The stockpile balance of Morris grade ore was very close to last year's figure of 25,560 tons:

Grade	Tons
Morris	27,060

d. Production by Months

	Days Worked	Average Number of Men	Morris Grade Tons	Tons per man per day
January	23½	152	27,724	8.05
February	22	153	28,612	8.72
March	25	153	32,805	8.91
April	24	155	27,243	7.65
May	22½	157	30,691	9.00
June	24	159	27,864	7.75
July	24	158	32,859	9.73
August	24	165	31,999	9.16
September	23	164	27,663	7.74
October	23½	162	25,545	7.00
November	23	161	26,434	7.14
December	23½	154	23,040	6.35
Average	23½	158		8.10

Production	342,479
Plus current year overrun	6,154
Total 1948	348,633

Productive efficiency reached a low in 1945 when sub level stoping was at a minimum. The increase in use of this system of mining in each of the last two years, combined with the partial change to sub level caving and with the production of the single Morris grade instead of Morris standard and Morris silicious, raised the average tons per man per day to a new high of 8.10 in 1948.

The working schedule of two shifts 5½ days per week which was placed in effect September 1st, 1945, continued through 1948 and the mine operated a total of 282 days.

f. Delays

No operating or production delays were reported in 1948. The shaft repairs, however, which caused a two week production loss in 1947, were continued in 1948 on a week end schedule of work consisting mainly of replacement of the 5½" x 7½" wood runners in the two skip compartments.

MORRIS MINE
ANNUAL REPORT
YEAR 1948

3. ANALYSIS

Shipments

The analysis of ore shipped by the Inland Steel Company from the Morris Mine in 1948 was as follows:

Grade	Tons	Iron	Phos.	Sil.	Mang.	Alum.	Sul.	Moist.
Morris								
Dry	347,134	55.985	.075	12.28	.49	3.23	.018	11.11
Natural		49.765	.067	10.92	.43	2.87	.016	11.11

Ore in Stock (Natural Analysis)

Grade	Tons	Iron	Phos.	Sil.	Mang.	Alum.	Sul.	Moist.
Morris	27,060	49.00	.065	12.04	.45	-	-	11.00

Ore Reserves - Expected Natural Analysis

Morris	3,763,437	50.00	.079	10.50	.43	2.80	.013	11.70
Morris Hi-Sulphur	276,247	52.17	.095	7.25	.40	2.27	.400	10.50

The only change made in 1948 on the expected analysis of ore reserves was a 1/2% reduction in iron content and consequent increase of the same amount in silica content from that reported in 1947. It should again be pointed out, however, that the ore in place included in the reserve estimate is expected to run about 8% in silica and that if dilution occurs to the above analysis, the mineable reserve should be increased about 25% over and above the estimated reserve.

4. ESTIMATE OF ORE RESERVES

Development in 1948 added 285,952 tons to the engineers estimate after allowance for ore mined during the year. Much the larger share of this increase occurred on Chase Lease #9, where the east boundary of the ore outline was extended by development on the -220' sub and the 9th Level to add to the reserve in this territory. The second largest increase occurred on Chase Lease #24, where the development work of #10 contract extended the ore limits of No. 79 deposit on subs in their stoping area above the new transfer drift at the -280' elevation. In contrast to the above the reserve picture on the Fee lands showed a reduction of 2,946 tons over last year, after taking into account the ore mined during the year but this was due entirely to the fact no new development was extended in the several areas in 1948, and the fact that the mining operations of the four contracts in the several areas therefore extracted a portion of the ore that had been proved up in 1946 and 1947. The December 31st estimate of ore reserves is summarized in the following table which shows by leases the changes that occurred in 1948.

MORRIS MINE
ANNUAL REPORT
YEAR 1948

4. ESTIMATE OF ORE RESERVES (cont.)

Description	Estimate 12-31-47	1948 Production	Estimate Deducting Product	Actual Estimate 12-31-48	Inc. or Dec. From 1947 Est.
Chase Lease #26	26,140	-	26,140	26,140	None
Chase Lease #25	33,273	-	33,273	33,273	"
Chase Lease #24	229,176	58,896	170,280	237,132	66,852
Chase Lease #24,Hi-S.	210,235	21,720	188,515	236,726	48,211
Chase Lease #9	2,242,348	177,395	2,064,953	2,238,788	173,835
Total Chase Leases	2,741,172	258,011	2,483,161	2,772,059	288,898
C.C.I.Co.Lands	1,321,672	90,622	1,231,050	1,228,104	2,946
C.C.I.Co.Lands,Hi-S.	39,521	-	39,521	39,521	None
Total C.C.I.Lands	1,361,193	90,622	1,270,571	1,267,625	2,946
GRAND TOTAL	4,102,365	348,633	3,753,732	4,039,684	285,952

5. LABOR AND WAGES

Inland Steel, in company with other operators in the Lake Superior District, signed an extension agreement with the CIO-Steelworkers Union but in 1948, in contrast to the year previous, the extension was concluded following the signing by most of the other operators. The new agreement provided for wage increases ranging from 9½¢ to 19¢ per hour and extended the 1947 collective bargaining agreement to May 9, 1950. The extension carried the provision that discussions may be held in 1949 on wages and social insurance with a provision for strike or lockout in the event no satisfactory settlement is reached.

The working force at the Morris Mine again showed little change with an average of 158 hourly rated employees during the year. It should be remembered that in 1947 the reporting of employees was changed to exclude all salaried personnel such as engineers, office force, captain and shift bosses. This, of course, places the Morris Mine on a different basis than the other mines in the district with respect to a comparison of the monthly tons per man figures. The Superintendent at the Morris property also reported there had been no change in the situation with regard to scarcity of employable experienced miners in this district, in comparison to the surplus usually encountered with Inland's operations on the Menominee Range.

6. SURFACE

The two major surface improvements completed in 1948 included the sewage disposal system consisting of two separate septic tanks, together with a filter bed so no sewage was introduced into the Carp River, and secondly in the area northwest of the shaft bounded by the Lake Superior & Ishpeming RR. on the south, the timber yard on the east, the Morris property line on the north and the new diversion ditch on the west a 14 acre settling basin was

MORRIS MINE
ANNUAL REPORT
YEAR 1948

6. SURFACE (Cont.)

confined by earth and rock dikes and having a capacity of about nine days pumping of underground water before overflow to the outlet leading to the diversion ditch at the north end. The object of the basin in settling out both solids and coloring matter from the mine discharge was attained beyond expectations in that the Carp River diversion, together with the over-flow from the settling basin, consisted of clear water from the time the basin was put into use. The first diversion was made experimentally in August and following repairs to the dikes lasting into September the diversion was then continued from that time forward. The removal of the Carp River water hazard from above the 9th Level mine areas was therefore accomplished without possibility of complaint because of colored mine water from property owners along and beyond the route of the new diversion channel.

Surface Pumping

Water pumped from the surface sand and gravel above ledge with the intent of reducing the water table over the ore bodies averaged 2015 gpm in 1946, 1642 gpm in 1947, and 1847 gpm in 1948. A seven months shutdown in 1947 of the 500 gpm No. 10 well to study the effectiveness of the normal pumping rate was responsible for the decreased quantity in 1947. This study had been made in consultation with the U. S. Geological Survey Ground Water experts and showed that indirectly through the effect on other wells nearer the caves pumping should be resumed from the No. 10 well. The well was therefore placed back in commission on January 7th and continued to furnish its share of the total through the remainder of the year within a variation of from 500 to 600 gpm. The following comparison shows the rates in effect at the several wells at the beginning and end of 1948:

Well Number	G.P.M. December 1947	G.P.M. December 1948
1	260	320
2	42	50
3	80	80
3A	270	327
5	134	225
8	425	300
9	121	92
10	Test	530
Average total	1332	1924

While the reduced pumping in 1947 had the effect of reversing the downward trend in the average water level on ledge, the opposite was true in 1948 with the restoration of pumping particularly in the No. 10 well. The total average drop in 1948 was larger than for some years past due to the pick-up of this reversal and the total amounted to 5.1' as compared to a loss of 3.2' in 1947. The 1948 picture is shown in the following tabulation by months:

MORRIS MINE
ANNUAL REPORT
YEAR 1948

6. SURFACE (Cont.)

Month	GPM Surface Pumping	Drop in Test Holes Feet
January	1830	0.2
February	2006	0.6
March	1945	0.0
April	2056	0.3
May	1755	0.0
June	1683	0.5
July	1919	0.9
August	1885	1.2
September	1668	0.6
October	1658	0.5
November	1832	0.9
December	1924	1.0
Average 1948	1847	0.4
Total 1948		5.1
Average 1947	1622	0.3
Total 1947		3.2

The average total drop in surface material above ledge amounted to 36.5' as shown by the readings at the test holes on Dec. 23, 1948:

Test Hole	Drop 8-25-37 to 12-23-48	Depth Remaining to Ledge
501	67.6	25.5
503	85.8	114.0
504	65.9	83.2
505	56.6	73.6
506	56.1	31.2
507	(123.3)	
508	(60.4)	(72.7)
509	(75.9)	(110.8)
510	34.4	88.9
511	30.1	124.3
512	49.3	112.4
514	28.4	97.8
515	17.7	110.9
516	(36.1)	(7.5)
517	20.2	91.9
518	35.4	73.0
519	55.0	102.5
520	(42.5)	
521	(28.5)	

MORRIS MINE
ANNUAL REPORT
YEAR 1948

6. SURFACE (Cont.)

Test Hole	Drop 8-25-37 to 12-23-48	Depth Remaining To Ledge
522	28.9	82.9
523	(36.5)	
524	78.2	21.5
526	16.4	97.6
527	22.7	52.3
528	(1.7)	(101.2)
531	8.3	68.2
532	(5.8)	78.2
533	31.1	100.9
534	0.0	93.9
Peronto well	(9.4)	
Total	730.3	1646.5
Avg. drop to 12-23-48	36.5	82.3

The total expense in connection with the surface pumping amounts to $19,137.00 in 1948 compared to $16,612.00 in 1947. The increase is accounted for by the slightly increased labor charges but mainly by the difference in power cost for the pumping of the average of 1847 gpm in 1948 as compared with 1622 gpm in 1947. The following tabulation comparison, however, brings out the fact that the increased mine production in 1948 reduced the cost per ton of ore produced from 6¢ in 1947 to 5½¢ in 1948.

	1947	1948
Average surface well pumping rate, gpm	1622	1847
Operating expenditure	$ 16,612	$ 19,137
Cost per ton of ore produced	.062	.055

MORRIS MINE
ANNUAL REPORT
YEAR 1948

7. UNDERGROUND

a. Pumping

The initial Morris surface cave occurred in March, 1939 and the following year the water entering the mine reached a high of 1157 gpm. Since 1940 the average has varied from a low of 844 gpm to new highs established in 1947 at 969.4 gpm and in 1948 a rate of 1076.6 gpm.

Extension of the underground workings, particularly at the east end of the 9th Level with a presumed extension therefore of cracks or water channels from the ledge and the surface caves, has no doubt caused the increased quantity during the past several years. This is shown in the following table which shows the pumping rates by levels for the past five years:

Averages	LEVELS					
Year	4th	6th	7th	8th	9th	Total
1944	149.2	46.5	180.1	267.0	252.4	895.2
1945	158.4	42.8	146.1	244.0	266.2	857.9
1946	147.3	44.1	153.4	254.9	278.8	888.4
1947	149.9	34.7	144.7	287.3	352.8	969.4
1948	140.5	25.1	122.2	274.3	514.5	1076.6

The increased quantity of water pumped and the higher labor cost combined to raise the underground pumping expense to a new high of $73,168.00 but this was off-set by increased mine production which reduced the cost per ton to the lowest figure in the past five years. A comparison of all pumping costs for the last five years is shown in the following table:

Year	Surface Pumping Optg.Expense	Underground Optg.Expense	Total Pumping Optg. Expense	Cost per ton Ore Produced
1948	$ 19,137	$ 73,168	$ 92,305	$ .265
1947	16,612	65,862	82,474	.308
1946	13,960	46,143	60,103	.324
1945	22,105	61,036	83,141	.349
1944	41,859	59,219	101,078	.327

b. Development

Underground development in 1948 was carried forward by an average of four contracts, and in contrast to 1947 when the new work centered above the Fee lands, the development in 1948 was mainly on the east end of #33 deposit on Chase Lease #9 and near the west end of the property in #79 deposit on Chase Lease #24. Development in general, therefore, added to the program that was begun in 1945 with the opening of the 9th Level and carried westerly the preparation for opening additional mining areas above this level. Two

MORRIS MINE
ANNUAL REPORT
YEAR 1948

7. UNDERGROUND (Cont.)

new sub level stopes were brought into production in 1948, and at the end of the year initial development was underway for two more stopes, one of which by No. 1 contract, will effect a resumption of mining operations above the east end of the 8th Level with the hope that stoping may be carried as high as the old 7th Level floor. This ore body has never been explored above the 8th Level as it had been too wet to mine.

The development that added most to the ore reserves in 1948 was the easterly extension of the intermediate sub drift connecting the raises between the 8th and 9th Levels easterly beyond formerly supposed limits of #33 deposit. This extension, however, was not unexpected and only confirmed the projected westerly pitch of #33 deposit downward from the 8th to 9th Levels. The most interesting development in 1948 was the considerable width of ore developed on and above the -280' sub by No. 10 contract in the higher than average sulphur #79 deposit in the northeasterly portion of Chase Lease #24. A disappointing development in 1948 was confirmation of the fact that the southerly extension of #33 deposit south on to the Fee lands below the -220' sub would in all probability be removed from the estimate of ore reserves due to dilution with dike stringers and the consequent inability to produce an acceptable grade of ore from this area. The development and mining operations of No. 16 contract on subs from the -180 to the -220 was therefore not expected to extend lower than the -240' sub in this area. Off-setting this disclosure on the Fee lands was the proven juncture of #84A and B deposits at a distance of 30' above the 9th Level by the development and mining operations of No. 6 contract near the east end of the Fee lands. The sub level stoping operations of No. 6 contract were the second most highly productive mining operation at the Morris property in 1948 and the westerly extension of this area, combined with the operations of No. 30 contract, are expected to continue their advance westerly into the known reserve above this level for at least some years in the future.

#75C deposit, which lies north of the center of #33 deposit, had been developed early in the year for stoping west of the 2000 W. coordinate line and up from the -290' transfer sub to the 8th Level. Sub level stoping was carried on by No. 13 contract as the number one producer in 1948 and toward the end of the year the open stope area had become too large to support the back and heavy falls of lean ore and jasper were experienced with consequent dilution of product. Late in 1948 it was determined that the stope would be allowed to fill and the remainder of the territory converted to the sub level caving system of mining.

MORRISMINE
ANNUAL REPORT
YEAR 1948

7. UNDERGROUND (Cont.)

A second interesting new development that was started near the end of the year was the starting of a raise near the 3300Wcoordinate line by No. 18 contract above the 8th Level. This raise was started in the slate footwall and is being extended to the height of the +220' sub to connect with an old raise which then extends as high as the 6th Level. It is intended to explore the possibility of a resumption of mining operations by the downward and easterly extension in ore in an old stope above the 7th Level centering approximately on this same 3300 W coordinate line. The development therefore of Nos. 1 and 18 contracts, both above the 8th Level, will be watched with interest in 1949.

c. Stoping

Mining operations continued on Chase Lease #24, Chase Lease #9 and the Fee lands to the south and east. The vertical extent ranged from the -30' sub above the 8th Level near the east end of Chase Lease #24 downward to the -260' sub near the east end of the 9th Level on the Fee lands in the sub level stoping operation of No. 6 contract in #84A deposit. The mine product came from an average of 13 contracts, about the same number as in 1947 and of this total an average of three were top slicing, 7 sub level caving and 3 sub level stoping.

The mining methods employed in 1948 were a carry-over from 1947 following change and production of a single Morris grade carrying a lower average iron content and a silica content ranging from 11% to 13%. The change to this single grade, of course, was of particular advantage in the sub level caving method where the controlled dilution was varied within limits to maintain maximum mining efficiency. The same might be said to apply to the later stages of mining in several of the more productive open sub level stopes, where falls of lean ore from the sides and back were absorbed in the mine product but again, of course, within variable limits depending on the day to day analysis of the production from other areas in the mine.

During December there were three sub level stopes in production, one by No. 10 contract in #79 deposit on Chase Lease #24, the second and third by Nos. 6 and 30 contracts on the Fee lands at the east end of theproperty above the 9th Level. These three stopes, together with the highly productive No. 13, were in operation practically throughout 1948 and were mainly responsible for the improved production and cost achieved at this property compared to the several prior years. The detailed description of mining operations follows:

MORRIS MINE
ANNUAL REPORT
YEAR 1948

7. UNDERGROUND (Cont.)

c. Stoping (cont.)

CHASE LEASE #24

Four contracts continued mining near the east end of this lease during 1948 on subs from the -30' to the -220'. #21 contract completed sub caving operations in #75B deposit on the -40' sub late in 1948 and in December dropped to the -60' sub, where sub caving was started at the new elevation by the advance of a transfer drift east toward Chase Lease #9 boundary line. #4 contract also completed sub caving operations farther west at this same -60' sub elevation and late in the year opened #75A deposit from #807 raise at the -90' elevation. The first drift here extended southwesterly, and indicated a narrowing of this ore body at the lower elevation, the drift near its west end contacting the jasper capping on both north and south sides.

The third mining contract on this lease, #9, continued sub caving operations southwest of the triple boundary corner in #82 deposit on subs from the -160' to the -190'. The largest area mined in 1948 was at the -170' elevation, where the pillar under the jasper capping west of the former sub level stope in this deposit was mined by sub caving south of #931 raise. In November the contract cut out the same raise at the -190' elevation and resumed mining near the west end of the deposit and under the jasper capping by the sub level stoping method on a small scale.

The important development by #10 contract in extending the former supposed limits of #79 deposit has been described under the development heading. The mining operations of this same contract were quite productive in 1948 in the extension of their sub level stope to the east under the jasper capping from the old transfer drift at the -220' elevation. Development of a new transfer at the lower elevation of the -240' sub was started in June but mining operations in 1948 nevertheless extended and widened the stope on subs from the -160' to the -220', the largest mined area occurring on the -190' sub, where the advance amounted to approximately 50' to the east, while the stope width was increased to 100' on the north-south dimensions.

FEE LANDS

Four contracts continued mining operations on the Fee Lands and the vertical extent of the sub caving and sub stoping systems ranged from the -50' to the -260' subs.

#7 contract early in the year completed sub caving operations on the -50' sub level near the east end of #87A deposit, and then spent the balance of 1948 using this same system in mining the ore at the -70' elevation both east and west of the boundary line between Chase Lease #9 and the Fee Lands. The total east-west length of the mining amounted to 220' straddling the boundary line, and a retreating system of mining from south to north toward the raise was employed. In December a small pillar south and east of the mining raise on the Fee Lands was as yet unmined at this elevation. #16 contract spent most of the year on the -180' sub, using a combined sub caving and sub stoping

MORRIS MINE
ANNUAL REPORT
YEAR 1948

7. UNDERGROUND (Cont.)

c. Stoping (Cont.)

FEE LANDS (cont.)

system of mining in the extreme southwest corner of #33 deposit. The mining here was a short distance east of the mining operations of #9 contract on Chase Lease #24 and about the same distance southeast of the triple boundary corner between Leases #9 and 24 and the Fee Lands. The mining here, as in former years, was beset with the drainage of excess water into the area and the grade of ore was at times below normal, since the deposit is cut with numerous dike stringers fanning off from the 15' main dike which forms the south boundary of #33 deposit farther east. Considerable testing was done in this deposit at the -190' sub after which actual mining operations were confined to a small stope south of the dike and extending a short distance to the west across the Chase Lease #24 boundary line. #16 contract in November dropped to the -220' sub, and by the end of the year had extended a new transfer drift south of #930A raise a distance of 80' in mixed dike and ore. The low iron analysis pointed to the fact this will probably be the last sub level opened near the bottom of this deposit and the mining area therefore on the -220' sub will also probably be limited in extent.

By far the larger share of the product from the Fee Lands in 1948 resulted from the sub level stoping operations of #6 and #30 contracts from above the east end of the 9th Level in #84A and #84C deposits. Stoping operations of #6 contract in #84A deposit ranged from the -70' sub level, a distance of 60' above the 8th Level, downward to the -260' sub which is only 60' above the 9th Level. Early in the year it had been determined that #84A deposit split into two wings, one along the south footwall and the other trending to the northwest toward the north slate footwall. The mining operations of #6 were extended in the northwest portion of the deposit, with the largest advance occurring on the -240' sub which was opened to an average diameter of 80'. The top mining of this contract in 1947 had reached as high as the -120' sub, and production in 1948 was aided by the arching of the back of this stope in ore and lean ore as high as the -70' sub, where the east-west advance amounted to close to 100'. Very little of this ore was blasted but the self caving was satisfactory in that very little dilution occurred in the stope because the arching process contacted the jasper a short distance above the -70' elevation. The production from this stope was second only to that of #13 stope on Chase Lease #9, and these two contracts accounted for a very large share of the larger production in 1948 which increased efficiency and lowered costs at the Morris Mine in comparison to several years past.

The sub level stoping operations of #30 contract were carried forward on a single shift basis throughout 1948 in #84C deposit and the west face of the stope was advanced from the Lloyd Mine across the boundary line into the Morris Mine about the middle of the year. The rate of mining in this deposit

MORRIS MINE
ANNUAL REPORT
YEAR 1948

7. UNDERGROUND (Cont.)

c. Stoping (Cont.)

FEE LANDS (Cont.)

was again purposely held to the single shift basis in order to absorb the higher phosphorus ore from this area into the regular mine grade and with the attempt to hold the total below .090. The largest advance in this stope occurred on the -180' sub where mining operations extended across the boundary line into the Morris Mine a distance of 25' and the total advance for the year amounted to 80' in an east-west direction. Late in 1948 further development was necessary in order to continue the stope in this direction and #30 contract therefore divided their operation to part time development and part time mining.

CHASE LEASE #9

The vertical extent of mining on this Lease ranged from the -50' sub above the 8th Level at the east end of #33 deposit to the lowest elevation stoped by #13 contract in #75C deposit at the -260' elevation. #3 and #5 contracts continued sub caving operations near the east end of #33 deposit on subs above the 8th Level from the -50' to the -110' sub. #5 contract caved a considerable area at the -90' elevation west of the operations of #7 contract extending across the boundary line into this Lease on the -70' sub, while the larger share of the mining done by #3 contract was at the -110' elevation and west of the new #912 raise extended from the 9th Level for this purpose.

Farther west in this same area in both #33 and #75C deposits the concentrated portion of mining operations on Chase Lease #9 progressed with #13 and #15, #11, #14 and #2 contracts. #15 contract early in the year extended a new transfer drift at the -150' elevation from the east end of #75C deposit and then spent the balance of the year sub caving this deposit from its center to the east on a retreating system with actual caving being done at the old 8th Level elevation. The sub caving mills for this operation were advanced to the 8th Level elevation in jasper north of the deposit with all sub caving drifts on a north-south line into and across the ore body from this development in rock.

#11, #14 and #2 contracts continued top slicing in the central portion of #33 deposit to furnish throughout the year a high grade product, which was used to maintain or uphold the analysis of the single Morris grade. The largest areas mined were on the 8th Level or -130' elevation by #2 contract and on the -140' sub by #14 contract. Late in the year, however, #11 contract converted frlm top slicing to sub caving by dropping from the -130' to the -150' sub where sub caving was started west of #926 raise toward the old top slicing territory mined an elevation below at the west end of #33 deposit.

MORRIS MINE
ANNUAL REPORT
YEAR 1948

7. UNDERGROUND (Cont.)

c. Stoping

CHASE LEASE #9 (Cont.)

The sub stoping operation of #13 contract, as in 1947, was the most productive single mining operation on the property. Late in 1947 development had been completed on the -290' sub and subs above for the open stoping of #75C deposit under the jasper capping and west of the 2000 W. coordinate line. Sub level stoping was carried on here throughout the year, extending from the -260' sub upwards to the back of the 8th Level. Near the close of 1948 the area had became too large to support the back and heavy falls of lean ore and jasper were experienced, so that it was necessary to allow the stope to fill, with the remainder of the territory being converted from sub level stoping to sub caving. The production, however, from this area before filling occurred was considerably in excess of the normal average for at times production was limited only by the amount of ore that could be scraped on the transfer drift on the -290' sub and the tramming capacity on the level below.

TILDEN MINE
ANNUAL REPORT
YEAR - 1948

1. GENERAL

The Tilden Mine operated continuously from May 17th to August 31st. This is the earliest that the pit has been closed down in the past several years. It was possible to stock considerable ore during the periods when no loading was required, and on August 31st there was approximately 79,000 tons of silica in stock, and it was decided to suspend operations.

The total product for the year was 140,692 tons, as compared with 168,669 tons in 1947. There was, however, considerably more low phos. ore produced this year, and with more trucks available it was possible to haul the Summit Pit ore direct to the crusher instead of stocking as previously in the East Pit and having to reload. If the requirements for low phos. ore in the future demand shipments early or late in the season, it will be necessary to increase the stockpile grounds and stock some of this grade. It would not be practicable to start up the pit next year before some 30,000 tons of silica ore had been loaded out of stockpile, thus providing work in restocking for the crew after they are once assembled. If low phos. was requested too early, there would be no outlet for the throwouts and also the crew would again have to be transferred to other properties. There are only two shovels now at the pit, and economical operation necessitates a more or less continuous operation in each grade rather than moving the shovels back and forth for successive cargoes.

The silica ore was loaded from the lower bench in the West Pit and mostly from the upper bench in the East Pit; although a small amount was removed when the shovel was on the lower bench. The low phos. ore was divided between the Summit Pit and both lower and upper benches of the East Pit. There is now sufficient width in the East Pit on the upper bench so that drilling of the lower bench can be resumed at any time. The position of the road to the Summit Pit along the South side of the East Pit has been changed along the latter and is to be extended more to the South and East. The loading of the ore was accomplished with the 120 Bucyrus and Marion shovels and the ore was transported to the crusher in seven fifteen-ton Euclid trucks.

The trucks and also some of the other equipment was transferred mostly to the Mather "A" Mine during the winter, and also to other company properties occasionally during the summer. Opening of the Mather "B" Shaft required the use of one truck nearly all the year and it is hoped that this will not be necessary in 1949, especially as one of the trucks purchased from the company's Mesabi properties, where it was being replaced, was almost totally wrecked late in the fall. It got out of control when being placed in the garage and went over a thirty foot embankment. Fortunately the driver was not injured too severely. It will not be necessary to replace this truck if the remaining six can be kept at the Tilden and the product desired is not increased materially over that of 1948.

Drilling was continuous while the mine was operating and was carried on with 2-29-T nine inch churn drills. The remaining holes in the West Pit were completed and then the drills were moved to the East Pit for the balance of the season. Short experiments were tried out with Carbon Insert bits, but to date no satisfactory results have been obtained. It is felt, however, that some such type of bit will be produced eventually and greatly increase the speed of drilling and consequently reduce the cost.

Three blasts were put off during the year; one in the Summit Pit and two in the East Pit. At the end of the season there was several months supply of broken ore on hand. It will be necessary, however, to drill and blast in the Summit Pit if there is a fairly large amount of low phos. ore required.

TILDEN MINE
ANNUAL REPORT
YEAR - 1948

1. GENERAL (Cont.)

It was necessary to employ a larger crew than usual during September and October after the pit was closed, as there was considerable repairing of equipment and also changes and improvements in the roads. The section of the road from the crusher to the East end of the office and extending part way toward the East Pit was given a covering of fine rock and macadam. This was felt necessary as it was very difficult to maintain this stretch when the trucks have to stop and start again each time they dump their load into the crusher, causing bad holes to develop. This improvement will also reduce the large amount of dust around the crusher and office.

The only new equipment purchased during 1948 was that of a portable compressor to eliminate the extensive piping and operation of the large compressor; both of which are unecconomical. This compressor was purchased from Joy Meyer Company at a cost of $4,557.85.

2. PRODUCTION: SHIPMENTS & INVENTORIES

a. Production by Grades

	1948	1947	Increase	Decrease
Tilden Silica	96,942	141,951		45,009
Tilden Low Phos.	43,750	26,718	17,032	
Total	140,692	168,669		27,977

b. Shipments

	Pocket	Stockpile	Total	Total Last Year
Tilden Silica	45,162	33,479	78,641	149,332
Tilden Low Phos.	43,750	-	43,750	25,392
Total	88,912	33,479	122,391	174,724
Total Last Year	109,359	65,365	174,724	
Decrease	20,447	31,886	52,333	

c. Stockpile Inventories

Grade	Balance on Hand Dec. 31, 1947	Stocked 1948	Shipped from Stockpile 1948	Balance on Hand Dec. 31, 1948
Tilden Silica	39,041	51,780	33,479	57,342
Tilden Low Phos.	0	0	0	0
Total	39,041	51,780	33,479	57,342

e. Product by Months

Month	Days Operated	Average Tonnage Per 8-Hr. Shift	Total Tons
May	11	1712	18,836
June	23	2031	46,716
July	21	1812	38,062
August	21	1766	37,078
Total	76	1851	140,692

The average product per shift showed an increase of 112 tons over that in 1947 and this was mostly due to having one extra truck available when stocking and also to less moving of shovels from one pit to another.

TILDEN MINE
ANNUAL REPORT
YEAR - 1948

2. PRODUCTION, SHIPMENTS & INVENTORIES

e. Product by Months (Cont.)

Distribution of Product by Pits

	1948	1947	Increase	Decrease
West Pit(lower bench)	62,674	93,446		30,772
East Pit	59,280	57,677	1,603	
Summit Pit	18,738	17,546	1,192	
Total	140,692	168,669		27,977

f. Ore Statement

	Tilden Silica	Tilden Low Phos.	Total	Total Last Year
On hand January 1, 1948	39,041	0	39,041	45,096
Output for Year	92,401	48,291	140,692	168,669
Transfers	4,541	4,541		
Total	135,983	43,750	179,733	213,765
Shipments	78,641	43,750	122,391	
Balance on hand December 31, 1948	57,342	0	57,342	39,041
Decrease in output			27,977	

Comparison of Working Schedules, 1946 to 1948

1948 - Pit idle January 1st to May 17th. Operated May 17th to August 31st. During part of the idle time a small crew was engaged in repairing, drilling, and stockpile loading. There was no work during January, February, March, and December.

1947 - Pit idle January 1st to July 7th. A small crew was employed during May and June on repairs and stockpile loading, the latter starting on May 14th. Operating one 8-hour shift six days per week July 7th to November 24th. Drilling was then also suspended and only a small crew remained in December for the necessary repairs.

1946 - Pit idle January 1st to May 22nd. Part crew repairing May 22nd to June 15th. Operating one 8-hour shift six days per week June 15th to November 30th. Gradually decreasing crew repairing and storing equipment November 30th to December 31st, except for one shift stocking ore in October. Stockpile loading was intermittent from May 22nd to November.

g. Delays

There were no major delays during 1948.

3. ANALYSIS

a. Average Mine Analysis on Shipments

Grade	Iron	Phos.	Sil.	Mang.	Alum.	Lime	Mag.	Sul.	Loss by Ignition
Tilden Silica	39.50	.035	41.61	.07	.74	.41	.25	.020	.25
Tilden Low Phos.	36.60	.015	46.20	.07	.71	.14	.10	.010	.29

TILDEN MINE
ANNUAL REPORT
YEAR - 1948

3. ANALYSIS (Cont).

b. Average Analysis on Straight Cargoes

	Mine			Lake Erie	
	Iron	Phos.	Sil.	Iron	Moist.
Tilden Silica	39.41	.039	41.73	39.79	2.04
Tilden Low Phos.	36.53	.015	46.12	37.45	1.37

c. Analysis of Ore in Stock

	Iron	Phos.	Sil.	Mang.	Alum	Lime	Mag.	Sul.	Loss	Moist.
Tilden Silica	39.82	.043	41.00	.07	.74	.41	.25	.020	.25	1.76

4. ESTIMATE OF ORE RESERVES

a. Developed Ore

1. West Pit - Above Floor at 1430'

Assumption: 13 Cu. Ft. equal one ton.

Total Stripped & Developed as of January 1, 1948	1,543,485 Tons
Mined during 1948	62,674 "
Total Remaining December 31, 1948	1,480,811 "

2. East Pit - Above Floor at 1440'

Assumption: 14 Cu. Ft. equal one ton.

Total Stripped & Developed as of January 1, 1948 1440' to 1500'	1,278.320 Tons
Total Stripped & Developed above 1500' as of January 1, 1948	1,835,568 "
Mined during 1948	59,280 "
Total Remaining above 1500' as of Dec. 31,1948	1,776,288 "
Total Remaining above 1440' as of Dec. 31,1948	3,054,608 "

3. Summit Pit - Above Floor at 1620'

Assumption: 14 Cu. Ft. equal one ton.

Total Stripped & Developed as of January 1, 1948	426,072 Tons
Mine during 1948	18,738 "
Total Remaining as of December 31, 1948	407,334 "

Total Developed Ore as of December 31, 1948

West Pit	1,480,811 Tons
East Pit	3,054,608 "
Summit Pit	407,334 "
Total all Pits	4,942,753 "

Broken Ore in Pits Inculuded Under Developed Ore

	West Pit Lower Bench	East Pit	Summit Pit	Total
December 31, 1948	0	67,888 Tons	34,556 Tons	102,444 Tons

TILDEN MINE
ANNUAL REPORT
YEAR - 1948

4. ESTIMATE OF ORE RESERVES

a. Developed Ore (Cont.)

Total Prospective Ore

West Pit
Balance remaining to be stripped — 500,000 Tons

East & Summit Pits
Total above floor at 1500' as of January 1, 1949 — 2,235,500 "

Total Prospective Ore January 1, 1949 — 2,735,500 "

c. Estimated Analysis of Reserves

	Iron	Phos.	Sil.	Mang.	Alum.	Lime	Mag.	Sul.	Ign.	Moist.
1. West Pit										
Dried	39.17	.050	41.91	.09	.90	.20	.22	.009	.24	
Natural	38.50	.049	41.20	.09	.88	.20	.22	.009	.24	1.70
2. East Pit										
Dried	37.00	.020	45.00	.09	.54	.20	.17	.009	.34	
Natural	36.50	.020	44.40	.09	.53	.20	.17	.009	.34	1.34
3. Summit Pit										
Dried	36.00	.015	46.00	.09	.54	.20	.17	.009	.34	
Natural	34.50	.015	45.40	.09	.54	.20	.17	.009	.34	

f. Estimate of Production

Production in the latter years has had to be limited by the amount required to be shipped plus the amount that could be stocked, and the maximum capacity of the present stockpile grounds is approximately 75,000 tons. The maximum production possible, however, is as follows:

	5 Day Per Week	6 Days per Week
Single Shift	224,000 Tons	282,000 Tons
Double Shift	400,000 Tons	500,000 Tons

It would be possible to obtain from 50,000 tons on single shift to 100,000 tons on double shift of low phos. ore grading .015.

5. LABOR & WAGES

a. Comments

The operating crew at the Tilden Mine showed an increase of six men over 1947 and this was due to employing men for churn drilling during the entire season in 1948. Due to the very short operating schedule this year, the men spent the most of their time at other company properties.

Effective July 16th there was an increase in wages which was based on a sliding scale starting with 9½ cents per hour for the surface laborers and increasing approximately 1 cent per hour for each 4 cent advance in hourly rate. There was a proportional increase for the foreman and clerk who were on salary, and at the end of the year the foreman received a one hundred dollar bonus.

TILDEN MINE
ANNUAL REPORT
YEAR - 1948

5. LABOR AND WAGES (Cont.)

a. Comments(Cont)

The men did not take any vacation but received their vacation pay in August. The operating season was so short that it was decided not to hamper shipping schedules by shutting down and the men would probably be off for several days when transferring to other properties at the completion of operations.

2 Men, or 7%, received pay for 3 weeks, based on 48 hours per week.
15 Men, or 52% received pay for 2 weeks, based on 48 hours per week.
9 Men, or 31% received pay for 1 week.
3 Men, or 10% were ineligible, as they had worked less than one year.

Four of these only worked part time at the Tilden Mine and received their vacation pay from other company properties.

b. Comparative Statement of Wages and Product.

	1948	1947	Incr.	Decr.
Product	140,692	168,669		27,977
Number of Days Operated	76	97		21
Average Number of Men Working	24	24		
Average Hourly Rate	1.488	1.418	.070	
Tons Per Man Per Hour	7.684	6.964	.720	
Labor Cost Per Ton	.193	.204		.011
Amount Paid for Labor	27,238.88	34,356.66		7,117.78

c. Nationality of Employees

	American Born	Foreign Born	Total
English.....	8	3	11
Swedish.....	3		3
Finnish.....	7	1	8
Irish.....	3		3
French Canadian.....	5		5
German.....	1		1
	27	4	31

7. OPEN PIT OPERATIONS

a. Stripping

There was no stripping done during 1948, nor will there be any further stripping necessary in 1949 unless a much larger product is required than has been the case for the last three years. A considerable increase in the amount of low phos. to be produced might require stripping to the west of the Summit Pit to avoid too narrow an opening when blasting on the upper bench.

f. Drilling, Blasting & Explosives

As there had been very little churn drilling required during 1947, it was necessary to start the two drills as soon as the pit opened this year. Drilling of the 24 holes on the West Bench was completed in June, when the drills were moved to the East Pit. Here some 50 holes were drilled on the upper bench, of which 14 were blasted in August. It is possible to obtain better footage per shift in the West Pit on account of the more level ground requiring less time to move and set up the equipment.

TILDEN MINE
ANNUAL REPORT
YEAR - 1948

7. OPEN PIT OPERATIONS

f. Drilling, Blasting & Explosives

1. Drilling(Cont.)

The Carboloy Company made two separate attempts to drill with a 9" bit with carbide inserts. This bit was forged at the pit according to their design and then sent to them to have the slots drilled for the inserts. They placed six of these inserts along the cutting edge of the bit with the two outside ones projecting far enough to keep the gauge. On both attempts, after a very short period of drilling, these outside inserts became loosened and fell out. The engineer in charge for the Carboloy Company is still optimistic however, and feels that eventually he will have a bit that will perform better than the regular bit in the same proportion, as the small carbide insert bits have shown a better drilling speed than the regular jack bits.

Despite the increase in wages, the cost per foot for drilling showed a decrease of .611 per foot, due in the most part to a more continuous drilling operation and also due to a 12% increase in the footage per shift.

Cost of Operating 9" Churn Drills in 1948

Total Footage Drilled 4,300

Operating	Labor	Supplies	Total	Cost Per Foot
Drilling	$6,189.71	$ 60.42	$6,250.13	1.454
Sharpening Bits	1,907.96	1,289.24	3,197.20	.743
New Bits	-	-	-	-
New Tools	-	1,219.61	1,219.61	.284
Electric Power	-	771.97	771.97	.179
Pipe & Fittings	-	189.59	189.59	.044
Truck & Tractor	1,113.71	85.46	1,199.17	.278
Total Operation	$9,211.38	$3,616.29	$12,827.67	2.982
Maintenance				
Drills	266.86	1,145.91	1,412.77	.329
Bit Dresser	135.57	461.38	596.95	.139
	$ 402.43	$1,607.29	$ 2,009.72	.468
Grand Total	$9,613.81	$5,223.58	$14,839.39	3.450

Comparison of Footages and Costs

	1948			1947		
	Footage Drilled	Footage Per 8-hr Shift	Cost Per Foot	Footage Drilled	Footage Per 8-hr Shift	Cost Per Foot
West Pit, Lower Bench	1,444	19.25	3.199	945	16.29	4.061
East Pit	2,856	17.96	3.577	-	-	-
Summit Pit	-	-	-	-	-	-
Total	4,300	18.37	3.450	945	16.29	4.061

TILDEN MINE
ANNUAL REPORT
YEAR - 1948

7. OPEN PIT OPERATIONS

f. Drilling, Blasting & Explosives

1. Drilling (Cont.)

Footage Obtained from Bits

	1948		1947	
	Bits Used	Footage Per Bit	Bits Used	Footage Per Bit
West Pit, Lower Bench	169	8.54	88	10.73
East Pit, North Side	350	8.16	-	-
Total	519	8.28	88	10.73

2. Blasting

There were three blasts put off at the Tilden Mine in 1948 as compared with one in 1947. Two of the blasts were in the East Pit and one in the Summit Pit. The Summit blast consisted of nine holes and an estimated 38,560 tons were broken. A small amount of this tonnage was shot over the South tip of the bench as this is still quite narrow, but the fragmentation was very good. The two East Pit blasts were also fairly small, as both were put off to make low phos. ore available to mix with that from the Summit Pit. There was a total of 24 holes blasted, and it was estimated that approximately 47,000 tons were broken. There was very little secondary blasting required here also.

Primary Blasting

Location	Date	No. of Holes	Footage Blasted	Estimated Tonnage	Pounds Explosives	Estimated Tons Ore Per Pound Explosive
Summit Pit	5/24/48	9	862	38,560	12,750	3.02
East Pit	6/ 5/48	10	364	11,010	4,550	2.45
East Pit	7/ 7/48	14	902	35,980	16,500	2.18

STATEMENT OF EXPLOSIVES USED FOR YEAR 1948

Primary Blasting

Kind		Quantity	Price	Amount
Gelamite D 7½	lb	20,950	1.4439	$3,026.50
Hercomite Bag 7½	"	12,850	1.3556	1,742.00
Total Powder		33,800	1.4103	$4,768.50
Blasting Supplies				
Primacord Bickford Fuse, Regular	M Ft.	1,000	32.00	32.00
Primacord Bickford Fuse, Wire Bound	"	3,000	41.50	124.50
Total Blasting Supplies		4,000		$ 156.50
Total All Explosives				$4,925.00

	1948	1947
Tons of Ore Blasted	85,550	72,951
Tons of Ore per Lb. of Powder	2.53	1.98
Cost per Ton for Powder	.0556	.0690
Cost per Ton for Blasting Supplies	.0019	.0025
Cost per Ton for All Explosives	.0575	.0715
Average Price per Lb. for Powder	.14103	.1365

TILDEN MINE
ANNUAL REPORT
YEAR - 1948

7. OPEN PIT OPERATIONS

f. Drilling, Blasting & Explosives

2. Blasting (Cont.)

Secondary Blasting

Kind		Quantity	Price	Amount
60% Gelatin	lb.	4,250	.1637	$696.61
Blasting Supplies				
Connecting Wire	"	4	.55	2.20
Crescent Fuse	M Ft.	10,900	7.656	83.45
#6 Blasting Caps	M	1,700	1.370	23.33
#7 Hot Wire Lighters	C	500	.92	4.60
Total Blasting Supplies				$113.58

Total Secondary Explosives

	1948	1947
Product	140,692	168,669
Pounds of Powder per Ton of Ore	.0331	.0455
Cost per Ton for Powder	.0049	.0036
Cost per Ton for Fuse & Caps	.0008	.0006
Cost per Ton for All Explosives	.0057	.0042
Average price per Lb. for Powder	.1637	.1625
Total All Explosives Used at Pit	$5,735.19	$5,921.07

Comparison of Blasting Costs

	Primary Blasting Cost per Ton Blasted	Secondary Blasting Cost per Ton Produced
1948	.0575	.0057
1947	.0715	.0042
1946	.0494	.0098
1945	.0416	.0052
1944	.0423	.0074
1943	.0468	.0016

g. Loading Operations

There were only two shovels at the Tilden Mine during 1948 and this occasioned a delay when changing from silica to low phos. production, as the shovel has to be moved from the West Pit to the Summit Pit. During the season there were seven 15-ton Euclid trucks owned by the Tilden, but one of these was rented to the Mather "B" Shaft almost the entire year. However, there were always five available, and when stocking, all six were used, which materially increased the tons per shift during that operation. There was very little maintenance required for either shovels or trucks, therefore there were practically no delays. In November one of the trucks which had been transferred from the Mesabi Range was almost completely smashed when it went thru the back of the garage and plunged down a thirty foot embankment. Fortunately the driver escaped

TILDEN MINE
ANNUAL REPORT
YEAR - 1948

7. OPEN PIT OPERATIONS

g. Loading Operations (Cont.)

with only a broken wrist. The engine had been frozen and split at the Mather "B" Shaft and it was being let down grade into the garage in gear, depending on the compression in the idle engine and the brakes. The gear shift lever disengaged and the brakes would not hold although it was moving fairly slow. Future operations of this kind will necessitate a hold back cable attached to another truck. It has been recommended by the adjuster that $4,506.00 be allowed as a claim for this damage.

The locality and tonnages for the two shovels during 1948 was distributed as follows:

Unit	Tons	Locality
No. 52 Shovel	33,479	Stockpile
	27,406	East Pit(includes 2,190 tons of Summit ore stocked in East Pit in 1947)
	62,674	Lower Bench, West Pit
Total	123,559	
No. 46 Shovel	18,738	Summit Pit
	34,064	East Pit(includes both low phos. and silica)
Total	52,802	

TILDEN MINE
ANNUAL REPORT
YEAR - 1948

8. COST OF OPERATIONS

a. Comparative Mining Cost

	1948	1947
Production	140,692	168,669
Operating Cost	.720	.520
General Mine Expense	.123	.095
Stocking Ore	.014	.016
Cost of Production	.857	.631
Depreciation - Movable Equipment	.000	.001
Depreciation - Plant & Equipment	.061	.070
Depreciation - Motorized Equipment	.015	.011
Depletion - Original Cost	.002	.003
Amortization of Development	.003	.003
Amortization of Stripping	.020	.020
Taxes	.046	.045
Loading from Stockpile	.008	.010
Total Cost at Mine	1.012	.794
Average Daily Product	1,851	1,739
Tons per Man per Day	61.47	55.71
Number of Days operated (1 8-hr. Shift)	76	97

TILDEN MINE
ANNUAL REPORT
YEAR - 1948

8. COST OF OPERATING (Cont.)

b. Detailed Cost Comparison

PIT OPERATING

	1948		1947	
Direct Ore	Amount	Per Ton	Amount	Per Ton
Drilling & Blasting	18,085.58	.129	20,507.52	.122
Power Shovels, Operating	7,740.93	.055	9,451.80	.056
Power Shovels, Maintenance	12,982.21	.092	5,582.09	.033
Euclid Trucks, Operating	6,734.57	.048	5,409.89	.032
Euclid Trucks, Maintenance	4,174.96	.030	1,740.21	.010
R.D. Tractor, Maintenance			80.88	.001
R.D. Tractor, Operating	175.77	.001		
Total Direct Ore	49,894.02	.355	42,772.39	.254
General Pit Expense				
Water Supply	87.37	.001	49.29	.000
Crushing & Screening	30,142.87	.214	28,253.11	.168
General Open Pit Expense	16,716.93	.119	12,600.61	.075
Open Pit Superintendence	4,406.89	.031	3,916.89	.023
Waste Pile Expense	49.64	.000	65.93	.000
Total General Expense(Pit)	51,403.70	.365	44,885.83	.266
TOTAL PIT OPERATION	101,297.72	.720	87,658.22	.520
Stocking Tilden Crushed Ore	2,000.92	.014	2,739.03	.016
GRAND TOTAL	103,298.64	.734	90,297.25	.536
General Mine Expense				
Mining Engineering	1,347.59	.010	575.73	.003
Mechanical & Electrical Engineering	125.03	.001	149.45	.001
Analysis & Grading	1,523.96	.011	1,385.62	.008
Safety Department	99.99	.001	179.15	.001
Special Expense	373.40	.003	343.33	.002
Ishpeming Office	1,366.17	.010	1,145.78	.007
Local & General Welfare	207.09	.001	211.88	.001
Mine Office	5,745.92	.041	5,359.11	.032
Insurance	1,419.10	.010	1,417.54	.008
Personal Injury	1,259.20	.009	804.57	.005
Social Security Taxes	1,301.14	.009	1,270.56	.008
Geological	- 76.75	.000	101.36	.001
Employees' Vacation Pay	2,463.12	.017	3,058.82	.018
Total General Mine Expense	17,308.46	.123	16,002.88	.095
COST OF PRODUCTION	120,607.10	.857	106,400.13	.631
Taxes	6,459.79	.046	7,653.63	.045
TOTAL	127,066.89	.903	114,053.76	.676