MAAS MINE
ANNUAL REPORT
YEAR 1946

6. SURFACE (Cont.)

e. Timber Yard (Cont.)

A detail of the operations of the treating plant is shown below:

Maas Mine Timber Treating Plant

Lineal feet of mine timber treated	12,051	
Amount chromated zinc chloride used	1,665	lbs.
Price per pound	.0827	
Cost of preservative	$ 137.70	
Miscellaneous supplies purchased	.89	
Plant depreciation	250.00	
Labor, peeling & treating timber	1,464.62	
Total Cost, excluding cost of timber	$1,853.21	
Cost per foot for peeling & treating	.154	

f. Drainage

Nos. 1 and 2 Wells operated continuously during 1946, not only removing water from the ledge, but also furnishing all the water used at the mine. Nothing further in the nature of testing for additional water was done. The capacity of the two wells has not changed for several years and averages about 925 g gallons per minute.

7. UNDERGROUND

a. Shaft-Sinking

There was no shaft-sinking at the Maas Mine in 1946.

b. Development

There was very little main level development during 1946, as the present cross-cuts and raises are ample to supply sufficient working places for the number of contracts necessary to keep the skip at full capacity. Next year, however, it will be necessary to put in an extensive permanent ventilation system in rock to connect the 6th Level with the 14th Level of the Negaunee Mine. There will also probably be two rock drifts, one on the 4th Level and one on the 5th, driven during 1947 to supply more working places in standard grade ore areas.

The 6700 Cross-Cut was extended 120' in ore to the dike and one raise was put up the -65 transfer to shorten the scraping distance. Three raises were put up in the 4200 Cross-Cut on the 4th Level to the 200' Sub, 95' above. These raises all encountered the ore just above the back of the level. #419 Raise was completed in the footwall to the 245' Sub or 166' above the level, for the purpose of draining the water from the ore area to the South.

MAAS MINE
ANNUAL REPORT
YEAR 1946

7. UNDERGROUND

b. Development (Cont.)

Table of Main Level Ore & Rock Development

Location	Raising		Drifting	
	Ore	Rock	Ore	Rock
4th Level	210'	156'		
6th Level	45'		147'	
Total	255'	156'	147'	

c. Stoping
General

There was an average of 33 contracts mining to the middle of July, when four more contracts, composed of miners transferred to the Maas from the Princeton Mine, were added. Later as the sub level stopes and sub caving contracts came into production, it was possible to eliminate one contract and split up several more into a single-shift basis. At the end of the year there were 34 double-shift contracts and four single-shift, and they averaged about 20% of their time repairing, either their respective raises or working places. Only one working place was lost during the strike, as the foremen and bosses did a fine job of maintenance work while the mine was idle. An extra hoisting crew was placed on the midnight shift about the middle of July, when it was observed that more ore was being mined than could be hoisted on two shifts without too much overtime.

Soon after the strike was over, it was decided to introduce sub caving, as this is a cheaper method of mining than top slicing. This had to be done gradually, as the miners had to be educated to this new system in order for it to be both safe and efficient. The results have been very satisfactory, and by the end of the year eight gangs were employed on this type of mining. There were two sub level stopes in operation and another was being developed in December, and the average daily production had increased from 1,927 tons in January to 2,536 in October. November and December were both lower on account of the large amount of absenteeism and the numerous holidays.

The East footwall pillar was being mined continuously during 1946 by four contracts, and by the end of the year mining in the Eastern end had reached two subs below the 3rd Level, and all of the ore in the Roman Catholic Cemetery was exhausted. Two of the contracts were mining by top slicing and two by sub caving.

An area which had been temporarily abandoned for several years, while mining to the North and East approached nearer this elevation, was reopened this year about half-way between 3rd and 4th Levels above the 4200 Cross-Cut, and three contracts started sub caving under an extremely irregular hanging. The ore is dry and so far the hanging has remained in place, which is ideal forthis system.

Above the 4100 Cross-Cut further to the West, one working place in the South end of the block was lost during the strike, being so close to the 4th Level where the weight was excessive, while to the North two other contracts, one top slicing and one sub caving were employed all year. The material is very hard here and the area is cut up by droppers from the hanging.

MAAS MINE
ANNUAL REPORT
YEAR 1946

7. UNDERGROUND

c. Stoping
General (Cont.)

To the West of the shaft cross-cut along the East boundary of the Race Course Lease considerable exploration work was done in a pillar between the 200' Sub and 3rd Level, but the ore was found to be too lean and this area was temporarily abandoned until December when a contract started to remove a small narrow pillar extending West to the sub level stope mined several years ago. This pillar will be mined by the sub caving system, as will also the large block lying approximately in the center of the ore body along the North footwall above the 4th Level. This latter area is very wet and various attempts have been made during the past years to start mining here, but with no success. However, a raise was put up this year in the footwall, and drifts along the contact 20' under the old workings have so successfully drained the water that two contracts were started from raises to the South late in the year, and it is believed that the results will be very satisfactory.

Mining was continued during 1946 in the 5300 and 5400 Blocks between the 4th and 5th Levels to the East of the Race Course Lease and will continue in the 5300 Block, while mining of the other will be stopped temporarily at the 40' Sub, which is practically completed, until the 5300 is finished. The footwall cuts across these two blocks and when the 5300 block reaches this elevation, it will be more economical to mine the remaining ore from the West, rather than cut through rock to reach the ore. Of the eight contracts in these two blocks, only one was using the sub caving system, while the others were top slicing.

In the Race Course Lease 11 contracts were mining between 4th and 5th Levels, all by the top slicing system on various elevations. These are the wettest contracts in the mine, and there is also more weight and harder material in this area. The contracts North of the main North dike were all mining ore of standard grade, while the ore South of the dike is about 90% special.

To the West of the Race Course Lease and also above the 5th Level seven contracts were mining between the North and South footwalls. Of the four situated in the narrow ore body along the North footwall, two were top slicing, one sub caving and one on single shift worked the entire year in the sub level stope. Despite the water and the hardness of the large chunks, the latter contract had an excellent production, keeping transfer men occupied scraping the dirt on the two remaining shifts. The ore in these contracts was all standard grade, although only a short distance above the 5th Level, where high sulphur ore was encountered in nearly all places. The other three contracts continued mining in the small areas opened up last year. One was sub caving and the other two top slicing. These latter areas were producing ore of special grade.

The only mining below the 5th Level was mostly sub level stope development, with actual stoping starting near the last of the year above the 6700 Cross-Cut. In the other stope to the South the transfer drifts have been completed, and in December the single-shift contract was starting the development raises. Some rock has been encountered in these raises, but it has not yet been determined whether or not this is the true hanging or seams of jasper interbedded in the ore.

MAAS MINE
ANNUAL REPORT
YEAR 1946

7. UNDERGROUND

c. Stoping

Detail

3rd Level - East Footwall Pillar

Actual mining of this pillar on the 3rd Level elevation was started in December, 1944 and completed in June, 1946. Progress was very slow, due to having to cross the old main level drifts. Upon completion of the mining on or above the 3rd Level, the main shaft cross-cut and footwall drifts were abandoned and rail, trolley, etc. removed.

Subs Between 3rd & 4th Levels

300' Sub Level - East Footwall Pillar

Two contracts were mining in the East end of this first sub under the 3rd Level from January to July, and two others starting later in the West end of the pillar were still top slicing at the end of the year. The footwall is very flat in this area and cuts off about 50' of ore on each succeeding sub level. In December Contracts #2 and #3 were mining from #429 and #431 Raises respectively.

280' Sub Level - East Footwall Pillar

This sub level was opened from #439 Raise, being cut 25' below the workings above so that sub level caving, rather than top slicing, could be started. Due to the shape of the area and the ore lying on the flat footwall to the North, it was necessary to use the radial drift system, rather than the regular type with cross-cuts at right angles. The results here have been fair, considering this is a new type of mining for the men and having to avoid intrusions of lean ore near the footwall. In December Contracts #5 and #6 were sub caving at this elevation. The ore mined from this pillar has all been of standard grade and produced mostly from the Maas Lease with small amounts from the Roman Catholic Cemetery Lease, which was completely exhausted in December, and the Cleveland-Cliffs Iron Company Strip, or North 1/3 of the D.S.S. & A. Railway right of way.

260' Sub Level

Considerable exploration work, consisting of dog drifts and raises, was done between the 200' Sub and 3rd Level near the East boundary of the Race Course Lease on the North footwall in an endeavor to open a small sub level stope in this small pillar. Very little high grade ore was found, however, and this work was abandoned in September of this year. What little ore remains will be mined upon completion of mining to the West. In November Contract #16 was moved to #300A Raise and started to remove the pillar lying between this raise and the stope to the West. They had completed one drift and slice along the footwall by the end of the year. Work here was carried on in the Maas, Race Course, and City of Negaunee Leases.

MAAS MINE
ANNUAL REPORT
YEAR 1946

7. UNDERGROUND

c. Stoping

Detail (Cont.)

245' Sub Level

When the mine resumed operations after the strike, it was decided to again attempt to open up the central North footwall pillar above the 4th Level, which is so extremely wet that several previous attempts had been abandoned. A rock raise was put up on the footwall in approximately the center of this pillar and after cutting out at this elevation, drifts were driven along the footwall to the East and West. The workings above were tapped and such a flow of water resulted that the raises to the South had almost dried up by the end of the year, and work was again started from these raises preparatory to sub caving this pillar. In December #42 Contract was still putting up short raises to the old workings. Upon completion of this work, they will cut out on the footwall 20' below and drive a new drainage drift to keep the water below the level of the mining places.

200' Sub Level

Three raises were put up from the 4200 Cross-Cut on the 4th Level to this sub from January to September, and in July, when a group of miners were transferred to the Maas from the Princeton, #12 Contract started to develop this area. The hanging is very irregular, and it was thought best to handle the ore on this elevation and stope or sub cave to the hanging, rather than open higher up and have considerable rock work to do. #12 completed their first drift to the Southwest in September and started to cave. The results have been very good here and also in #48 Contract, who started a similar drift from the second raise in October. In November a third contract was placed in the last raise and in December all three contracts were mining ore of standard grade from the Maas Lease.

185' Sub Level

Early in the year a connection in rock was completed from near the East end of the North footwall drift on the 4th Level via raise and sub level to the 13th Level Negaunee Mine for a permanent ventilation passage to eliminate the necessity of maintaining drifts on the 3rd Level in the Roman Catholic Cemetery Lease, thus allowing the lease to be terminated when mining was exhausted. In November, when it was found that the drainage of the central area had been successful, Contract #30 cut out at this elevation in #412 Raise and started to drive a transfer drift to the East. Raises will be put up to the 285' elevation and sub caving of this pillar will be started. In December two contracts were driving transfer drifts, one at #412 and one at #420 at a slightly higher elevation.

170' Sub Level

Mining of the so-called 4100 Block was completed in February, and the contracts moved to a lower elevation in May, after the strike was over.

7. UNDERGROUND

c. Stoping

Detail (Cont.)

160' Sub Level

The South end of this same pillar was mined by top slicing from May to September, while the North end was still being mined by sub caving from the 150' Sub, at the end of the year.

150' Sub Level

#20 Contract cut out in #4107 Raise at this elevation in June, being one of the first contracts to start mining by the sub caving system in the Maas Mine. By September they had completed one drift and cross-cut and started to cave. The results were very good for the original cross-cut, but unfortunately a large horse of jasper was encountered that lay below the ore on the sub above, while on adjacent drifts the ore is overlaid by jasper and this necessitates driving around the jasper to save rock work and still reach the ore beyond. This extra work increases the proportion of drifting to caving, and thus the overall results are not as good as had been expected. Contract #7 started slicing in the center of this same mining block in October, and both contracts continued through December.

One Contract was mining to the South near the Maas area boundary in January, but severe crushing occurred here during the strike, and this area had to be abandoned until such time as raises are put up from the 5th Level.

The ore removed from the 4100 and 4200 Mining Blocks was all of standard grade and from the Maas Lease.

4th Level

The only work on the 4th Level during 1946 was the putting up of the previously mentioned raises. Three were in the 4200 Cross-Cut and all encountered the ore just above the back of the level. Raise #419 was in the jasper footwall for its entire length of 135' and is located on the North side of the North footwall drift approximately 400' East of the main shaft cross-cut.

Subs Between 4th & 5th Levels

100' Sub Level

Top slicing was carried on at this elevation in two different areas. In the 5300 Block lying East of the Race Course Lease mining was confined during 1946 to the Southern end, and by December there only remained a small pillar being removed by sub caving from the 75' Sub. The small ore body lying between the North footwall andthe main North dike in the Race Course Lease was mined continuously during the year. This ore body is constantly decreasing in size as the footwall is approaching the dike more rapidly than the hanging extends to the West. The progress is slow due to very hard material and the short slices.

MAAS MINE
ANNUAL REPORT
YEAR 1946

7. UNDERGROUND

c. Stoping

Detail (Cont.)

90' Sub Level

Late in 1945 the 5300 Block was cut at #5318 Raise and a ventilation and traveling connection made to the North with the 4th Level above. Contracts have been added from time to time and by the end of the year four contracts were top slicing and one was sub caving in this area. The material on the footwall side of the raises is hard, and there is also considerable water encountered. The ore is of standard grade and entirely in the Maas Lease.

75' Sub Level

#28 Contract cut out in #5327 Raise in the South end of the block mentioned above and was the first contract to start mining by the sub caving system in the Maas Mine. They drove their drift and first cross-cut intending to cave by the regular cross-haul method, but before they had completed caving above the cross-cut, the weight became so excessive that it was impossible to maintain either drift and therefore the system was changed to radial drifting and caving. The results here have been very satisfactory despite the extra weight. Occasional runs of high sulphur ore have been encountered, but for the most part the ore has been of standard grade.

65' Sub Level

Work at this elevation in the footwall ore body just West of the Race Course Lease was completed in January. Further to the West in the sub level stope, which is controlled by the transfer on the 25' Sub, the ore lying between the dike on the North and the jasper on the South has attained a width of 82' and reached an elevation of 85'. The hanging continues to be very firm, remaining in place and therefore not causing any dilution. The ore is also of standard grade, although only a short distance above the main footwall drift on the 5th Level where the sulphur content was very high. Despite the large flow of water and the difficulty of breaking the very hard chunks of lump ore, too large to pass through the grizzly, an average of 80 tons per man has been generally maintained.

50' Sub Level

Three contracts have been top slicing continuously in the area just West of the Race Course Lease. The hanging wall is very steep and has not allowed the ore to extend appreciably to the South for several subs. In December Contracts #18 and #19 had almost completed mining at this elevation. The third contract in the next raise to the East finished in August and started sub caving 25' below. The cross section of the sub level stope on this sub level is from 20' wide at the West end to 75' wide at a point 120' to the East. The unmined length of the stope is 170' and should insure mining here well through 1947.

MAAS MINE
ANNUAL REPORT
YEAR 1946

7. UNDERGROUND

c. Stoping

Detail (Cont.)

40' Sub Level

Mining by the top slicing system has been steady throughout the year in the 5400 Mining Block lying along the East boundary of the Race Course. Mining in the northern end of this area was started at this elevation late in 1945 and by December of this year the mining was almost completed with only one contract remaining out of the four who had been employed during most of the year. It is not intended to do any more work in this block until mining in the area to the East reaches this elevation. The footwall is very flat and it will be more economical to recover the small amount of ore lying to the East on the sub level below from raises put up from 6th Level along the Race Courseboundary, rather than do the rock work necessary to reach this ore from the 5300 Cross-Cut on 5th Level.

The ore removed covered the Race Course, City of Negaunee, and Maas leases and was almost entirely of special grade. The sub level stope at the extreme West end was also worked on this elevation, being the first sub above the transfer.

25' Sub Level

Contract #14 cut out at this elevation from #5022 Raise just West of the Race Course lease in August and started to develop for sub caving. In December they were driving the third slice, having previously caved above the first two.

One contract, remaining here for the entire year, together with one other contract, comprised of men transferred from the Princeton Mine in July, have been mining by top slicing in the Race Course Lease between the North footwall and the main North dike. By December these two contracts had mined approximately 75% of the area. All three contracts were producing ore of standard grade.

South of the dike in the main ore body in the Race Course Lease one contract was mining special grade ore during 1946 and one pillar remained to be mined in December.

10' Sub Level

All of the mining on this elevation during 1946, confined to the Race Course Lease, was just South of the main North dike and the ore was approximately 50% special grade. This area is quite wet, and as it is partly under jasper hanging, the water causes numerous rock runs. It is also probably one of the most expensive to maintain on account of the extreme weight. In December three contracts were slicing in this area.

To the West of the Race Course Lease one contract was top slicing at #6409 Raise until September, when this small area was exhausted and the contract moved to the sub below. The material here is quite hard and of special grade.

MAAS MINE
ANNUAL REPORT
YEAR 1946

7. UNDERGROUND

c. Stoping

Detail (Cont.)

00' Sub Level

In the fall it was decided to start one more contract on sub caving, and therefore #22 cut out in #6410 Raise 25' below the old workings. Later #1 also started here and drifted to their own raise #6409. They will mine by top slicing so as to get all this area on one elevation, they being one sub ahead of #22. The ore lies mostly in the Maas Lease, with the exception of a small amount extending into the Race Course. In December #22 was caving and #1 slicing.

Three contracts spent most of the year slicing in the main ore body in the Race Course Lease, and here too they were greatly handicapped by weight and water. All of the ore mined at this elevation and below was of special grade. Late in the year #30 Contract was removed and placed on 4th Level in a standard ore area. Contracts #24 and #44 were top slicing here in December.

A small amount of ore was mined in the Southwest part of the mine by sub caving from the 5th Level. The hanging was very irregular, and in some instances the ore went as high as the 10' Sub.

The second, or #17, sub level stope, described later in this report reached this elevation before encountering the jasper. The size of the ore body here is very small but will probably widen and also possibly gain in height as mining progresses to the North.

5th Level

Actual mining of this level started early in 1945 along the South footwall both in and to the West of the Race Course Lease. Both areas were quite wet, and in order not to delay the miners on account of having to wait for motor trains, transfers were cut out just above the 6th Level, the ore allowed to accumulate here and partially drain before being scraped into the cars. By the end of the year approximately one-third of the ore in the 6200 Block had been removed and one contract was top slicing from #6210 Raise. Until November two contracts were slicing from #630 and #632 Raises and when one was removed to mine in standard ore above the 4th Level, the other had only three small pillars remaining in December.

When mining in the above area, a limit had been established to the West on account of the economical distance to scrape, and it was noticed that the jasper here appeared to take an upswing. After the strike it was decided to explore this area, and therefore a drift was started to the Southwest from #6411 Raise. The jasper was encountered earlier than had been anticipated, but nearer the raise the ore was found to extend some 30 to 40', and this was mined by the sub caving system. Work here was completed in August and the contract moved elsewhere.

MAAS MINE
ANNUAL REPORT
YEAR 1946

7. UNDERGROUND

c. Stoping

Detail (Cont.)

A connection for ventilation was made from the 5800 Cross-Cut to #17 Stope by driving a small dog drift from one of the stope raises on the incline to the 5th Level elevation. Considerable ore was encountered, although it had been expected that this drift would be entirely in the hanging. The jasper only extended to the East some 40' from the edge of the stope and the remaining 80' was in ore, until just before holing to the level. Further exploration will be carried on next year to determine the height and extent of this ore, and possibly another sub level stope can be developed. The jasper in #17 Stope so far has limited the width to 40' at this elevation, but at 70' from the Southern end, which had been the progress up to December, the jasper appears to be widening, and it is hoped that a cross-section of 80' may be obtained.

-65' Sub Level

Late in the fall of 1945 a transfer drift was driven at this elevation in the West end of the ore body to develop a sub level stope from the 6th Level. The ore was known to extend slightly above the 5th Level, and from the known outline of the hanging, it appeared a favorable location for stoping. After the strike raises were put up to the hanging in the South end and stoping started in September. The stope now extends from the mill sub at -50' elevation to +5', and in December one single-shift contract was stoping over a section approximately 40' wide by 50' long. The total distance which can be stoped from this transfer is 160' and the width should soon reach 80'.. The ore when broken is removed by a transfer man on two or three shifts, depending on the amount. Another contract spent the last three months extending development to the North with dog drifts and raises so that the miners would not be delayed. The stope was averaging 80 tons per man per day at the last of the year.

-100' Sub Level

In order to further increase production and decrease costs, it was decided to open two more sub level stopes by driving transfers East and West at the elevation of the back of the 6th Level cross-cut. #29 Contract started this work in August and by November 15 had completed two drifts, one 200' to the West and the other 170' to the East. The footwall was encountered in this latter, and then a small drift extended to obtain the necessary information as to the location of the main dike. This was reached at 200' from the 6700 cross-cut. In December raises were being put up in the West drift to determine the hanging, preparatory to stoping. The drifts were lined with plank and rail, and a new 25 H.P. scraping unit, purchased this year, was installed.

6th Level

The only new advance on the 6th Level during 1946 was extending 6700 Cross-Cut 120' in January. This encountered the East-West dike which will be the limit of mining for the stopes. No raises were put up from the level during the year. There was, however, a very heavy maintenance program, as when this

MAAS MINE
ANNUAL REPORT
YEAR 1946

7. UNDERGROUND

c. Stoping

Detail (Cont.)

6th Level (Cont.)

level was opened, it was impossible to obtain treated timber, and therefore it was necessary to replace nearly all of the sets this year. This should insure very little work for several years, as the treated timber generally lasts about 10 years. Some steel sets were also put in where the ground was slabby and yet very little weight is expected.

d. Timbering

TIMBER STATEMENT FOR THE YEAR 1946

Kind	Lineal Ft.	Avg. Price Per Ft.	Amount 1946	Amount 1945
6" x 8" Cribbing Timber	67,349	.0549	3,694.70	2,812.54
8" x 10" Stulls	42,619	.1062	4,526.72	6,371.36
10" x 12" Stulls	87,004	.1582	13,762.02	13,731.67
12" x 14" Stulls	33,403	.2058	6,872.71	8,253.54
Treated Timber	9,806	.3228	3,165.20	1,531.78
Total 1946	240,181	.1333	32,021.35	
Total 1945	283,435	.1154		32,700.89
		Per 100 Ft.		
7' Lagging	983,240	1.451	14,262.86	21,133.62
8½' Poles	976,219	2.444	23,863.03	31,935.19
Total 1946	1,959,459	1.946	38,125.89	
Total 1945	3,051,166	1.739		53,068.81
Grand Total 1946			70,147.24	
Grand Total 1945				85,769.70
Product, Tons			476,348	558,633
Feet of Timber per Ton of Ore - Stulls & Cribbing			.5042	.5073
Feet of Stull Timber Only per Ton of Ore			.3628	.4132
Feet of Lagging per Ton of Ore			2.06	2.69
Feet of Poles per Ton of Ore			2.049	2.769
Feet of Lagging per Foot of Timber			4.0937	5.3059
Feet of Poles per Foot of Timber			4.0645	5.459
Cost per Ton for Timber			.0673	.0585
Cost per Ton for Lagging			.0299	.0378
Cost per Ton for Poles			.0501	.0572
Cost per Ton for All Timber			.1473	.1535

MAAS MINE
ANNUAL REPORT
YEAR 1946

7. UNDERGROUND

d. Timbering (Cont.)

Total Cost for Timber, Lagging, Poles, Etc. and Cost per Ton

Year	Amount	Cost per Ton
1946	70,147.24	.1473
1945	85,769.70	.1535
1944	100,622.46	.1740
1943	111,613.33	.1565
1942	93,785.17	.1063

Although the price of timber increased almost .02 per foot during 1946, the total cost per ton for timber decreased nearly .01, as compared with 1945, and nearly .03 as compared with 1944. There would have been a further decrease if it had not been for the strike. During the four months when the mine was idle, the bosses did considerable repairing, and for several months after the strike more timber was used in repairing than would have been necessary under normal conditions. The introduction of sub level caving reduced the amount of timber sufficient to more than offset this increase and with more of this type of mining being used, a still further decrease should be possible in 1947.

f. Explosives, Drilling and Blasting

EXPLOSIVES STATEMENT FOR THE YEAR 1946

Stoping and Ore Development

Kind		Quantity	Average Price	Amount 1946	Amount 1945
1¼" 60% Amonia Gel. Powder	lbs.	14,500	.1257	1,822.50	753.25
1¼ Gelamite #1	"	25,395	.1164	2,955.43	27,085.01
1¼" Hercomite 2X	"	156,355	.1236	19,320.55	
Total Powder 1946		196,250	.1228	24,098.48	
Total Powder 1945		242,009	.1150		27,838.26
Fuse	M Ft.	665,040	5.595	3,720.58	4,589.93
#6 Blasting Caps	M	93,103	13.14	1,223.39	1,546.44
Electric Blasting Caps	Cwt.	2,087	13.38	279.16	163.38
Powder Bags	Ea.	81	3.45	279.45	386.40
Tamping Bags	M	5,000	5.00	25.00	75.00
Fuse Lighters	"	15,000	6.75	101.28	202.56
Primacord	"	11,000	32.00	352.00	
Miscellaneous				19.38	9.90
#18 - 2 Cond. Blasting Wire	M Ft.				34.92
Master Fuse Lighters	M	500	19.85	9.93	10.04
Total Fuse, Caps, Etc.				6,010.17	7,018.57
Total All Explosives				30,108.65	34,856.83

MAAS MINE
ANNUAL REPORT
YEAR 1946

7. UNDERGROUND

f. Explosives, Drilling and Blasting (Cont.)

	1946	1945
Product, Tons	476,348	558,633
Pounds Powder per Ton of Ore	.4120	.4332
Cost per Ton for Powder	.0506	.0498
Cost per Ton for Fuse, Caps, Etc.	.0126	.0126
Cost per Ton for All Explosives	.0632	.0624

Rock Development

Kind		Quantity	Average Price	Amount 1946	Amount 1945
Hercomite 2X	lbs.	1,395	.1125	156.95	
1¼" Gelamite #1	"	1,425	.1150	163.87	371.21
Total Powder 1946		2,820	.1138	320.82	
Total Powder 1945		3,228	.1150		371.21
Fuse	M Ft.	3,960	5.133	20.33	30.22
#6 Blasting Caps	M	440	12.20	5.37	8.29
Electric Blasting Caps	Cwt.	346	11.84	40.96	
Total Fuse, Caps, Etc.				66.66	38.51
Total All Explosives				387.48	409.72
Total Explosives Used at Mine				30,496.13	35,266.55
Average Price per Pound for Powder				.1227	.1150

Statement showing cost per ton for explosives, exclusive of rock development, for the period 1942 to 1946:

Year	Cost per Ton	Production
1946	.0632	476,348
1945	.0624	558,633
1944	.0562	578,307
1943	.0528	713,069
1942	.0555	882,399

It was possible to keep the cost per ton for explosives at almost the same figure as for 1945, although the cost per pound of powder increased about two cents and the prices of other blasting supplies also increased. The introduction of Hercomite powder, which cost half a cent per pound less than the Gelamite formerly used and of which there were also more sticks of powder per 100 pounds, caused this overall cost to be held about the same, and the results from its use were very satisfactory.

MAAS MINE
ANNUAL REPORT
YEAR 1946

7. UNDERGROUND

h. Mining & Loading

The ore produced in 1946 was mined by three different systems of mining, and the proportion of each was 80% top slicing, 7% sub level stoping, and 13% sub caving. The last system was only started this year in the Maas Mine and up to the end of the year only six contract were using it, but it is intended to increase these contracts as rapidly as possible. It is very evident that both of these latter systems produce ore at a decreased cost, as 15% of the total contracts produced 20% of the total product.

It was found that the 15 and 20 h.p. scraper units were inadequate for transfer work in the sub level stopes and therefore two 25 h.p. units with faster rope speed were purchased and larger scrapers designed to use with these hoists. Some additional hoists were also purchased from the Negaunee and Princeton Mines.

Water continued to be the greatest problem and caused the most delay. Approximately 20% of the total product had to be loaded directly into the skip, at one car to a skip instead of a car and a half as with dry dirt, and then dumped on stockpile because it was too wet to ship. This of course introduces the extra cost of loading again from stockpile when sufficiently dry.

The Maas ore body in general has probably the hardest material of the soft ore properties, and therefore practically all drilling has been changed to the wet type of machine using jacklegs and jackbits. Most of this change occurred in 1945, but was nearly completed in 1946. A saving in direct cost of steel has been accomplished, and there is also the increased speed of drilling, less dust in the contracts, and the availability of water in the contracts in case of a fire.

Loading of the ore was continued in the same manner as in the past, and additional main level cars were purchased from the Princeton Mine to enable the use of longer trains. Several transfers were cut out just above the level so that wet ore could be accumulated there without delay to the miners and some of the water allowed to drain off before the ore was loaded into cars.

A large amount of overtime has been required, on account of the mine operating 12 shifts per week, to keep the levels clean and also do the necessary repairs to timber on the main levels and in the shaft during periods when the mine was not operating, namely on Sundays.

A new type of blasting powder was introduced by the Hercules Powder Company when the cost of supplies started to increase. This lower cost powder has proved very satisfactory except in loading upper holes. It is a very loose granular powder, and when the cartridges become torn, due to rough edges in the holes, the powder runs out before it can be tamped into place. Therefore a small amount of Gelamite powder, which is more plastic, has been used by the stoping and sub caving contracts.

MAAS MINE
ANNUAL REPORT
YEAR 1946

7. UNDERGROUND

i. Ventilation

The ventilation of the 4th Level area was greatly improved during 1946 by a permanent connection in rock from the East end of the North footwall drift on 4th Level, by raise and drift, to the 13th Level Negaunee Mine. This air, together with that coming from a connection above the 5th Level with the 14th Level Negaunee Mine, is forced through the workings to the 6th Level and exhausted at the shaft. It will be necessary next year to drift and raise some 500' in rock from the 6th Level Maas to the 14th Level Negaunee, as the air on the 6th Level at present is not adequate to properly ventilate the working places. When the Negaunee Mine has completed mining, then this connection will provide a large volume of fresh air that can be forced upward through the workings and discharged on the 5th Level as also will be the air coming from the previously-mentioned 4th Level connection. This should make a very satisfactory arrangement and supply sufficient fresh air to all the working places.

j. Pumping

The amount of water being pumped from underground has increased somewhat as compared with last year, and this is no doubt due to opening new areas under the hanging in the Western part of the mine where entirely different sources are being tapped. The total, however, is still below the average being pumped before the surface wells were installed. There are now three plunger type pumps at the main station on the 3rd Level, any two of which can handle the total volume.

The number of gallons per minute pumped both on surface and underground is shown below:

Underground Pumping

Month	1946	1945	1938*
January	1,104	1,054	1,240
February	1,082	1,049	1,442
March	1,091	1,041	1,367
April	1,139	1,051	1,379
May	1,165	1,051	1,545
June	1,110	1,076	1,372
July	1,137	1,068	1,438
August	1,271	1,053	1,391
September	1,222	1,050	1,434
October	1,225	1,062	1,644
November	1,135	1,055	1,408
December	1,106	1,096	1,496
Total Average	1,149	1,058	1,496

*Before surface wells were in operation.

Underground Weir Readings & Surface Wells

Year	1st Level	2nd Level	3rd Level	4th Level	5th Level	Total Undg.	Surface
1938*	73	52	500	400	230	1,255	
1945	67	57	250	335	270	979	925
1946	52	22	202	412	293	982	925

MAAS MINE
ANNUAL REPORT
YEAR 1946

8. COST OF OPERATING

a. Comparative Mining Cost

	1946	1945
Product	476,348	558,633
Underground Cost	2.061	1.955
Surface Cost	.174	.191
General Mine Expense	.361	.377
Cost of Production	2.596	2.523
Depletion - Original Cost	.094	.114
Increment	.000	.000
Depreciation - Plant & Equipment	.047	.050
Development	.054	.071
Taxes	.194	.225
Loading & Shipping	.059	.051
Total Cost at Mine	3.046	3.034
Budget, Estimated Cost per Ton	3.037	3.046
Number of Days Operated	218	301
Number of Shifts & Hours:		
1 8-hour	3	12
2 8-hour	215	289
Average Daily Product	2,185	1,856

Cost of Production

	1946	%	1945	%
Labor	1.819	70.1	1,673	66.3
Supplies	.777	29.9	.850	33.7
Total	2.596	100.0	2.523	100.0

MAAS MINE
ANNUAL REPORT
YEAR 1946

8. COST OF OPERATING

b. Detailed Cost Comparison

	1946		1945	
Underground Costs	Amount	Per Ton	Amount	Per Ton
1. Exploring in Mine	477.43	.001	2,800.97	.005
2. Development in Rock	2,387.46	.005	2,218.39	.004
4. Development in Ore	3,343.33	.007	22,789.44	.041
5. Stoping	330,664.94	.694	345,757.90	.619
6. Timbering	307,747.50	.646	372,503.66	.667
7. Tramming	122,971.96	.258	109,171.92	.195
8. Ventilation	9,500.60	.020	16,505.31	.030
9. Pumping	51,342.15	.108	63,729.73	.114
10. Compressors & Air Pipes	39,848.27	.085	52,657.89	.094
11. Back Filling			335.69	.001
12. Underground Superintendence	29,229.60	.061	34,248.92	.061
14. Maintenance, Compr. & Drills	1,287.03	.003	3,421.84	.006
15. Scrapers & Mechanical Loaders	41,107.30	.086	36,215.47	.065
16. Electric Tram Equipment	28,798.35	.060	25,170.32	.045
17. Pumping Machinery	12,963.84	.027	4,728.66	.008
Total Underground Costs	981,669.76	2.061	1,092,256.11	1.955
Surface Costs				
18. Hoisting	32,944.98	.070	42,085.26	.076
19. Stocking Ore	16,427.12	.035	14,393.61	.026
21. Dry House	12,358.60	.026	14,739.72	.026
22. General Surface	8,302.33	.017	9,700.83	.017
23. Maintenance Hoisting Equipment	5,682.17	.012	16,670.77	.030
24. Shaft	4,371.72	.009	4,106.40	.007
25. Top Tram Equipment	2,070.13	.004	2,767.71	.005
26. Docks, Trestles, & Pockets	636.21	.001	1,109.07	.002
27. Mine Buildings	142.29	.000	1,021.51	.002
Total Surface Costs	82,935.55	.174	106,594.88	.191
General Mine Expense				
28. Insurance	4,402.92	.009	4,691.74	.008
29. Mining Engineering	5,348.85	.011	4,057.55	.007
30. Mechanical & Electrical Engineering	1,727.17	.004	2,391.81	.004
31. Analysis & Grading	23,472.46	.049	39,647.70	.072
32. Personal Injury	27,958.31	.059	37,013.64	.066
33. Safety Department	2,298.22	.005	2,425.32	.004
34. Telephones & Safety Devices	2,093.65	.004	3,235.63	.006
35. Local & General Welfare	3,466.17	.007	4,642.17	.008
36. Sp. Exp.,Pens. & Allowances	6,185.89	.013	10,046.09	.018
37. Ishpeming Office	21,934.85	.047	25,476.10	.046
39. Mine Office	20,981.91	.044	23,625.64	.042
Social Security Taxes	17,130.02	.036	20,239.40	.036
Employees' Vacation Pay	34,340.43	.072	31,982.39	.058
Group Annuity Premiums	620.08	.001	1,042.43	.002
Total General Mine Expense	171,960.93	.361	210,517.61	.377
Cost of Production	1,236,566.24	2.596	1,409,368.60	2.523

MAAS MINE
ANNUAL REPORT
YEAR 1946

8. COST OF OPERATING

b. Detailed Cost Comparison (Cont.)

(1) Days and Shifts

Year	Days Worked	Shifts & Hours	Men Employed	Total Days Worked
1946	218	1 & 2-8	297	81,253 3/4
1945	301	1 & 2-8	352	105,555 1/4
Decrease	83		55	24,301 1/2

Total Men Employed in December of Each Year

	1946	1945	1944
Surface	57	63	66
Underground	304	286	305
Total	361	349	371

(2) Wages

There was an increase of 18½¢ per hour to daily wage earners, effective May 22nd, and at the same time there was a raise of from 10 to 15% to the salaried employees. In December the foremen and shift bosses received a bonus of $150.00.

(3) Comparison of Production

Year	Production	Average Daily Product
1946	476,348	2,185
1945	558,633	1,856
Increase		329
Decrease	82,285	

(4) Comparison of Number of Men & Wages

Year	No. Men	No. Days	Amount	Rate Per Day
1946	297	81,253 3/4	832,387.31	10.24
1945	352	105,555 1/4	902,156.52	8.55
Decrease	55	24,301 1/2	69,769.21	1.69

(5) Tons Per Man Per Day

	1946	1945	Increase
Surface	28.23	28.07	.16
Underground	6.94	6.52	.42
Total	5.57	5.29	.28

(6) Cost of Production

Year	Amount	Cost Per Ton
1946	1,236,566.24	2.596
1945	1,409,368.60	2.523
Increase		.073
Decrease	172,802.36	

MAAS MINE
ANNUAL REPORT
YEAR 1946

8. COST OF OPERATING

b. Detailed Cost Comparison (Cont.)

(6) Cost of Production (Cont.)

	Amount				Cost per Ton		
Year	Labor	%	Supplies	%	Labor	Supplies	Total
1946	866,705.33	70.2	369,860.91	29.8	1.819	.777	2.596
1945	934,620.12	66.3	474,748.48	33.7	1.673	.850	2.523
Increase		3.9			.146		.073
Decrease	67,914.79		104,887.57	3.9		.073	

The cost of production for 1946 showed an increase of .073 per ton, which did not reflect the entire increase in wages and the price of supplies. This represented only a 2.77% increase over last year, while the increase in wages averaged 18.5%, and the price of supplies was estimated to have gone up about 20%. It was possible to hold the cost down due to the increased production which resulted from employing more miners and being able to mine more of the ore by sub stoping and sub caving. It is interesting to note that this is the first time that the proportion of labor cost has reached 70%, an increase of about 5% over the average for the past five years.

A few of the accounts where more explanation is necessary are listed below:

(7) Detail of Accounts

UNDERGROUND COSTS

3. Development in Rock

	Drifting	Raising	Total Feet	Cost Per Foot
1946		156'	156'	15.30
1945	73'	140'	213'	10.49
Increase		16'		4.81
Decrease	73'		57'	

There was very little development in rock required in either 1945 or 1946, as the 6th Level was completed in 1944, thus opening a considerable number of new working places. The large increase in cost per foot was due partly to higher wages, but mostly to the fact that the work this year occurred in several places where the footage was small and there was more delay in getting started.

4. Development in Ore

	Drifting	Raising	Total Feet	Cost Per Foot
1946	147'	255'	402'	10.96
1945	933'	1,267'	2,200'	10.36
Increase				.60
Decrease	786'	1,109'	1,895'	

Ore development showed a large decrease due to a change in bookkeeping when it was decided to show only main level development in this account. There was very little of this type of work required in 1946, as most of the raising from 6th Level was completed last year.

MAAS MINE
ANNUAL REPORT
YEAR 1946

8. COST OF OPERATING

b. Detailed Cost Comparison

(7) Detail of Accounts (Cont.)

5. Stoping

	Labor	Cost Per Ton	Supplies	Cost Per Ton	Total
1946	286,320.02	.601	44,344.92	.093	.694
1945	297,696.80	.533	48,061.10	.086	.619
Increase		.068		.007	.075
Decrease	11,376.78		3,716.18		

The increase in the cost per ton for stoping was almost entirely due to the increase in wages, as most of the supply cost is for blasting, and the increase in price of powder was offset by using a cheaper grade. Again the increase in labor would have been greater if other types of mining had not been introduced.

6. Timbering

	Labor	%	Cost Per Ton	Supplies	%	Cost Per Tpn	Total Cost Per Ton
1946	224,799.20	73.1	.472	82,948.30	26.9	.174	.646
1945	269,117.04	72.2	.482	103,386.62	27.8	.185	.667
Decrease	44,317.84		.010	20,438.32		.011	.021

The cost for timbering showed a slight decrease despite the fact that the price per foot for timber advanced approximately .02, and this was due to a larger proportion of the ore being mined in 1946 by sub level stoping and sub level caving.

9. Pumping

	Surface Gallons Pumped	Gals. Per Min.	Underground Gallons Pumped	Gals. Per Min.	Total Cost for Power
1946	486,180,000	925	603,914,400	1,149	43,794.51
1945	473,040,000	900	555,380,166	1,058	45,471.06
Increase	13,140,000	25	47,534,234	91	
Decrease					1,676.55

There was a slight increase in the amount of water pumped on surface and also approximately a 10% increase underground, although there was less precipitation in 1946 than in 1945. The increase underground was due to opening up two new territories under the hanging, both of which produced considerable water.

17. Pumping Machinery

	Amount	Cost Per Ton
1946	12,963.84	.027
1945	4,728.66	.008
Increase	8,235.18	.019

The increase in pumping machinery was due to completing the installation of the Aldrich Pump on 3rd Level and also to very extensive repairs to pumps purchased from the Princeton Mine for use on 5th Level and 6th Level. There was also an unusual amount of repairs to the present pumps.

MAAS MINE
ANNUAL REPORT
YEAR 1946

8. COST OF OPERATING

b. Detailed Cost Comparison

(7) Detail of Accounts (Cont.)

Total Underground Costs

	Labor	Cost Per Ton	Supplies	Cost Per Ton
1946	719,412.59	1.511	262,257.17	.550
1945	789,449.50	1.414	302,806.61	.541
Increase		.097		.009
Decrease	70,036.91		40,549.44	

The increase in the total underground costs was almost entirely due to the raise in wages of 18½¢ per hour. There were considerable purchases of equipment, but outside of two new 25 h.p. scraper hoist units, the majority was purchased from the Princeton Mine at a nominal cost.

SURFACE COSTS

21 Dry House Expense

	1946	1945	Incr.	Decr.
Coal Used in Heating Plant, Tons	935½	1,070		134½
Cost per Ton for Coal	7.10	6.72	.38	
Cost of Coal	6,646.39	7,178.64		532.25

23. Hoisting Equipment

	Amount	Cost Per Ton
1946	5,682.17	.012
1945	16,670.77	.030
Decrease	10,988.60	.018

There was an unusual cost in 1945 due to extensive repairs to the skip hoist motor.

Total Surface Costs

	Labor	Cost Per Ton	Supplies	Cost Per Ton
1946	50,950.35	.107	31,985.20	.067
1945	57,362.70	.103	49,232.18	.088
Increase		.004		
Decrease	6,412.35		17,246.98	.021

There was very little difference in the labor cost on surface, as it was found possible to operate with enough less men to offset the increase in wages. The supplies were more nearly normal in 1946, whereas they were quite large in 1945, mostly due to the skip hoist failure mentioned above.

MAAS MINE
ANNUAL REPORT
YEAR 1946

8. COST OF OPERATING

b. Detailed Cost Comparison

(7) Detail of Accounts (Cont.)

GENERAL MINE EXPENSE

31 Analysis & Grading

	No. Determinations	Lab. Expense Cost Per Determination	Analysis & Grading	Total Cost Per Ton
1946	128,889	.135222	.182113	.049
1945	267,992	.123519	.147944	.072
Increase		.011703	.034169	
Decrease	139,103			.023

There were less samples taken on account of the three and a half months' idle period, and it has also been possible to eliminate some of the underground samples where daily analysis was not needed for grading purposes.

Analysis of Supplies Used

	1946 Amount	1946 Per Ton	1945 Amount	1945 Per Ton
41. General Supplies	23,448.28	.049	25,782.42	.044
42. Iron & Steel	9,434.47	.020	7,688.49	.014
43. Oil & Grease	3,181.94	.007	3,244.86	.006
44. Machinery Supplies	27,200.03	.057	9,231.95	.017
45. Explosives	30,559.08	.064	35,338.42	.063
46. Lumber & Timber	75,124,46	.158	94,750.54	.170
47. Fuel	5,793.89	.012	7,178.64	.013
48. Electric Power	101,602.51	.213	132,473.77	.237
49. Sundries	32.19	.000	39,113.59	.070
50. Other Mines & Accounts			291.35	.001
Total	276,376.85	.580	354,549.29	.635

There was very little difference in the total cost per ton for supplies used in 1946 as compared with 1945, but there was a decided change in the accounting, as supplies of a more permanent value, formerly charged to Column 9, or Sundries, were distributed this year through the various supply accounts, showing a decrease of $39,000, or .07 per ton in that particular account.

Idle Expense due to Strike

The following statement shows the expense incurred while the mine was idle from February 8th to May 21st, due to the employees' strike called by the C.I.O. This amount was not taken up on the cost sheet for the year and is only shown for a matter of record.

	Labor	Supplies	Total	Cost per Ton On Year's Product
Underground Costs	20,860.91	20,148.86	41,009.77	.086
Surface Costs	8,232.77	4,323.64	12,556.41	.026
General Mine Expense	17,444.00	21,611.05	39,055.05	.082
Taxes		35,493.00		.074
Total	46,537.68	81,576.55	128,114.23	.268

MAAS MINE
ANNUAL REPORT
YEAR 1946

8. COST OF OPERATING

Idle Expense (Cont.)

This amount would have been reduced by approximately $3,500.00 if there had not been the back-to-work movement during three days in the latter part of March, when some 80 men decided to try and work. These were composed of both union and non-union men, and they would have continued to work except for intimidation by the more radical strikers influenced by outside "goons". The bosses, office force, policemen, and union hoisting engineers, pumpmen, and firemen continued at work during the entire period, together with a few union repair men allowed to work for the first month. The underground bosses kept up the repairing as much as possible and this accounted for considerable supply expense to that account. There was also some unloading of railroad cars of timber on surface despite the fact that the union tried to stop this type of work.

Total Number of Days Worked During Idle Period:

Surface	2,032
Underground	2,257½
Total	4,289½

There would have been a decrease of approximately 225 days if some of the men had not attempted a back-to-work movement in March. On the other hand, if the union had allowed men to work and keep up the necessary maintenance underground, this reduction would have been offset by about the same amount, and thus the total would have remained the same.

10. TAXES

	1946		1945	
	VALUATION	TAXES	VALUATION	TAXES
Maas Mine	$ 1,790,000	79,016.51	$ 1,785,000	75,305.40
Race Course	585,000	25,823.83	615,000	25,945.56
Stockpile & Equipment	490,000	21,630.22	540,000	22,781.47
Miscellaneous Parcels	8,665	382.50	9,140	358.58
Total Oprtg. Maas Mine	2,873,665	126,853.06	2,949,140	124,418.01
Collection Fees		1,268.53		1,244.18
Total		128,121.59		125,662.19
Tax Rate		4.41433		4.21879
Total City of Negaunee Tax		523,650.90		542,472.42
Maas Mine % of City Tax		24.2%		23%
Maas Mine Rented Houses	97,065	4,284.84	103,265	4,356.62
Mineral Lands, Etc.	15,035	663.69	15,510	654.35
Total Houses & Lands	112,100	4,948.53	118,775	5,010.97
Collection Fees		49.49		50.11
Total		4,998.02		5,061.08

MAAS MINE
ANNUAL REPORT
YEAR 1946

11. ACCIDENTS AND PERSONAL INJURY

	1946	1944
Fatal	0	1
Time Lost, over 4 months	3	3
Time Lost, 1 to 4 months	5	9
Time Lost, less than 1 month	4	7
Total Compensable Accidents	12	20

On December 31, 1946 payments were being made on four accidents which occurred prior to January,1, 1946. One is a death claim and three are receiving full compensation. In addition, Nicholas Piri was accepted as an occupational disease case during the year.

The total amount paid in compensation for injuries received during 1946 was $2,201.50, as compared with $3,036.50 in 1945.

The following is a description of the more serious accidents.

Date of Accident	Name of Injured Man	Description of Accident
1-12-46	Joseph Barabe	Barabe, a carpenter, was smoothing a short piece of board on the planer when the blade struck a knot in the board, throwing it aside and allowing his hand to come in contact with the blade. He suffered a laceration of the palm and was home about four months. He should have used the pusher instead of having his hand on the board.
4-18-45	Matt Hahka	Hahka was repairing the back of a drift, loading the loose rock into a car, when a piece rolled out and struck him on his leg. He kept on working, but his leg bothered him and in April of this year an operation was performed, causing him to lose about four months.
3-7-46	Nicholas Tambling	Tambling slipped and fell on the rail while walking along the drift. He bruised his shoulder to such an extent that an operation was necessary and he lost 18 weeks.
11-6-46	Joseph St. Arnaud	St. Arnaud had recently returned from active service and was apparently still very nervous, as when there was a slight movement of the ground he dashed for the ladder road, raised the sollar clear and then either jumped or fell down the raise about 50' to the level. He suffered a bad leg fracture and is still home.

MAAS MINE
ANNUAL REPORT
YEAR 1946

13. EQUIPMENT AND PROPOSED EQUIPMENT

a. Steam Shovels

Due to the intermittent stockpile loading during 1946 when the shovels were idle for quite long periods and then a large amount was required at short notice, it was necessary to use three shovels at these latter periods and Nos. #27 and #43, railroad type shovels, were at the Maas Mine part of the season. No. 45, caterpillar type steam shovel, was repaired at the mine and is kept on the premises the entire year. It is expected that a new Diesel-operated caterpillar shovel will be available next year, and this together with the No. 45, will greatly decrease the cost of loading, as only three men will be required on the new type, compared to nine on the No. 27 or 43 and five on the No. 45.

c. Stocking Trestles

The tramming system on the Southeast trestle was changed from endless rope to larry car this year, which completes the installation of the latter on all of the trestles. The Northwest trestle was the only one dismantled and re-erected during 1946, and at the end of the shipping season there was considerable ore remaining under the other three trestles.

d. Scraper Hoists

Ten scraper hoist units were purchased during 1946, two 25 h.p. Ingersoll-Rand (new) and eight 15 and 20 h.p. units from the Negaunee and Princeton Mines.

e. Skips & Cages

There was no change in the design or estimated capacity of the skips during 1946, and only minor repairs were made to either skips or cages.

Main Level Cars

14 main level 64 cubic foot rocker dump cars were purchased in 1946 from the Princeton Mine.

15. POWER

The following is the rate charged per K.W. hour by months in 1946.

January	$ .0140
February	.0134
March	.0142
April	.0140
May	.0142
June	.0136
July	.0134
August	.0130
September	.0132
October	.0130
November	.0132
December	.0134
Average 1946	.0135
Average 1945	.0137

MAAS MINE
ANNUAL REPORT
YEAR 1946

17. CONDITION OF PREMISES

The grounds and shrubbery around the mine buildings were kept in good condition and presented a very favorable appearance during the year. There were no changes of note.

18. MAAS CRUSHER

The Maas Crusher only operated two days during 1946, when Cliffs Shaft Lump was crushed about the middle of June. There were no major repairs needed during the year.

	1946	1945
Cliffs Shaft Lump	4,678 Tons	10,250 Tons
Negaunee Lump		9,646 "
Princeton		47 "
	4,678 Tons	19,943 Tons

NEGAUNEE MINE
ANNUAL REPORT
YEAR 1946

1. GENERAL:

The Negaunee Mine was operated on a two-shift, six day per week schedule during the entire year of 1946. In general this schedule is somewhat more efficient from a cost and production standpoint despite the added labor expense of overtime wages.

On February 8th the labor strike of the United Steelworkers Union was called and the mine remained idle until May 22nd, a total of eighty-seven working days. This idle period resulted in considerable damage to the active mining contracts a s well as portions of the main level development. Approximately one month's operation was required to restore the mine to a point where full production could be resumed. For all practical purposes this was attained in July and since that time general operating conditions have been very favorable. The production in 1946 was 416,021 tons as compared with 654,447 tons in 1945. The stockpile overrun which was accumulated and accredited to the year amounted to 12,039 tons. At the close of shipping season the total ore in stock amounted to 64,238 tons.

The product resulted from the three main leases, viz., the Negaunee Lease, Maas Lease and the South Shore Right of Way. The major part of the product was mined by the top slicing method (86%) while the remaining 14% was mined by the sub-level stoping method. There is no anticipated change in mining method for the remaining life of the Negaunee Mine.

With reference to exploration work there was some diamond drilling to determine local extensions of ore in various areas. However, there was no appreciable amount of ore discovered or developed. The general outline of the present ore bodies are well defined and the life of the mine depends on the size of the ore bodies and the number of mining places or locations.

Throughout the year there was an ample supply of labor and due to the slow depletion of mining areas no new employees were hired. A considerable number of men were transferred to the Mather Mine although some returning servicemen remained at the Negaunee Mine in positions which required younger men.

2. PRODUCTION: SHIPMENTS & INVENTORIES

a. Production by Grades:

	1946	1945	Decrease
Negaunee Ore	216,510	282,654	66,144
South Shore Right of Way Ore	28,414	70,782	42,368
Negaunee-Maas Ore	171,097	301,011	129,914
Total Ore	416,021	654,447	238,426
Rock	14,250	21,545	7,295
Total Hoist	430,271	675,992	245,721

Skip capacity reduced from 5.5 tons to 5.3 tons 11/10/43.

NEGAUNEE MINE
ANNUAL REPORT
YEAR 1946

2. PRODUCTION: SHIPMENTS & INVENTORIES: (CONT.)

b. Shipments:

	Pocket Tons	Stockpile Tons	Total Tons	Total Tons Last Year
Negaunee Ore	140,710	83,247	223,957	282,202
South Shore R of Way Ore	20,574	12,308	32,883	68,970
Negaunee-Maas Ore	117,188	21,395	138,582	277,303
Total 1946	278,472	116,950	395,422	628,475
Total 1945	420,810	207,665	628,475	
Decrease	142,338	90,715	233,053	

Shipments decreased 37.1% in 1946 and were 20,599 tons less than the product for the year.

c. Stockpile Inventories:

	Dec. 31st, 1946	Dec. 31st, 1945	Increase	Decrease
Negaunee Ore	27,367	32,226		4,859
South Shore R of Way Ore	5,156	9,437		4,281
Negaunee-Maas Ore	70,040	37,525	32,515	
Tot al	102,563	79,188	23,375	

Including estimated overrun there were approximately 64,238 tons in stock at the end of shipping season.

d. Division of Product by Levels:

	1946	Percentage	1945	Percentage
9th Level	55,966	13.45	86,020	13.14
14th Level	360,055	86.55*	571,203	86.86
Total	416,021	100.00	657,223	100.00

*1945 stockpile overrun, 2,776 tons, shipped in 1946.

e. Production by Months:

Month	Negaunee	S.S.R/W.	Maas	Total Ore	Rock
January	24,697	1,492	23,043	49,232	1,435
Februa ry	5,829	288	5,506	11,623	290
March	424		53	477	--
April	---	---	---	---	--
May	5,537	554	2,663	8,754	390
June	25,547	2,005	12,492	40,044	2,825
July	31,771	3,189	21,520	56,480	1,290
August	24,325	2,480	24,393	51,198	1,145
September	18,519	5,971	22,106	46,596	1,410
October	26,670	4,609	22,901	54,180	1,340
November	22,415	2,695	17,822	42,932	2,280
December	19,512	4,356	18,598	42,466	1,845
Total	205,246	27,639	171,097	403,982	14,250
Stkpile Overrun	11,264	775	---	12,039	
Total 1946	216,510	28,414	171,097	416,021	14,250
Total 1945	285,242*	70,970*	301,011	657,223*	21,545
Decrease	68,732	42,556	129,914	241,202	7,295

*1945 stockpile overrun, 2,776 tons, shipped in 1946.

Negaunee Ore	2,588
S.S.R/W Ore	177
	2,776

NEGAUNEE MINE
ANNUAL REPORT
YEAR 1946

2. PRODUCTION: SHIPMENTS & INVENTORIES: (CONT.)

The product by leases was distributed as follows:

	1946	1945	Decrease
Negaunee Mine Company	216,510	285,242	68,732
S 1/2 R. of Way	28,414	70,970	42,556
Maas Lease	150,096	262,195	112,099
N 1/3 R. of Way	13,432	24,987	11,555
N 1/6 R. of Way	7,569	13,829	6,260
Total	416,021	657,223*	241,202

*1945 stockpile overrun, 2,776 tons, shipped in 1946.

f. Ore Statement:

	Negaunee	S.S.R/W.	Maas	Total 1946	Total 1945
On Hand Jan. 1, 1946	32,226	9,437	37,525	79,188	53,216
Product for Year	205,246	27,639	171,097	403,982	649,675
Stockpile Overrun	13,852	963	---	14,815*	4,772
Total	251,324	38,039	208,622	497,985	707,663
Shipments	223,957	32,883	138,582	395,422	628,475
Balance on Hand	27,367	5,156	70,040	102,563	79,188
Decrease in Product	77,408	43,143	125,142	245,693	81,515
Increase in Ore on Hand	4,859	4,281	32,515	23,375	25,972

*2,776 tons prior year's stockpile overrun included.

g. Delays:

August 2nd - 1-1/2 hours delay - Loss of Product - 140 tons
Broken power brake rod on skip hoist.

August 3rd - 8 hours delay - Loss of Product - 1,000 tons
Severe rain & lightning storm. Shaft pump station flooded and compressor motor damaged - four coils cut out.

September 3rd - 2 hours delay - Loss of Product - None
Lightning struck substation damaging compressor motor - three additional coils cut out.

November 21st - 1/2 hour delay - Loss of Product - None
No current.

December 9th - 2 hours delay - Loss of Product - None
Changing skip.

The total loss of product for the year on account of delays amounted to 1,140 tons as compared with 1,422 tons lost in 1945.

3. ANALYSIS:

a. Average Mine Analysis on Output:

	1946				1945			
Grade	Tons	Iron	Phos.	Sil.	Tons	Iron	Phos.	Sil.
Negaunee	205,246	59.59	.087	8.81	282,654	59.71	.087	8.12
Neg.-Maas	171,097	59.71	.086	8.54	296,239	59.99	.090	8.20
S.S.R/W.	27,639	58.55	.093	9.96	70,782	60.21	.086	7.74

NEGAUNEE MINE
ANNUAL REPORT
YEAR 1946

3. ANALYSIS: (CONT.)

b. Average Mine Analysis on Straight Cargoes:

	Mine			Lake Erie	
Negaunee	Iron	Phos.	Silica	Iron	Moisture
Negaunee Ore	59.31	.088	8.45	59.64	10.65

4. ESTIMATE OF ORE RESERVES:

a. Developed Ore:

Assumption:
12 Cubic feet equals one ton.
10% deducted for rock & loss in mining.

			Leased from Maas Mine				
Area	Negaunee Lease	S½ R of W or ¾ of Adams Strip	N 1/6 R of W or ¼ Adams Strip	N 1/3 R of W or C.C.I.Co. Strip	Maas Area	Special Grade	Total Tons
9th Level	46,383						46,383
13th to 14th Levels	175,624	62,403	12,898	34,139	461,806		746,870
Below 14th Level	2,083	4,167		375	35,275	59,000	100,900
Total Gross Tons 11/30/46	224,090	66,570	12,898	34,514	497,081	59,000	894,153
Less December 1946 Production	19,512	4,356	1,254	3,035	14,309		42,466
Total Gross Tons 12/31/46	204,578	62,214	11,644	31,479	482,772	59,000	851,687
Less 10% for Rock & Loss in Mining	22,409	6,657	1,290	3,451	49,708	5,900	89,415
Net Total 12/31/46	182,169	55,557	10,354	28,028	433,064	53,100	762,272

Maas Lease Ore	524,546 tons
Negaunee Lease Ore	182,169 "
South Shore R of Way Ore	55,557 "
Total	762,272 tons

The actual developed ore in '46 amounted to approximately 171,000 tons and was derived from several areas which proved to be slightly larger than the previous estimate. These areas are located in the stoping territory along the south footwall. Due to the irregular outline of the footwall and jasper capping more ore was mined than was anticipated.

b. Prospective Ore:

All ore in the mine is developed.

c. Estimated Analysis:

Grade	Ore Reserves:		Approximate Expected Natural Analysis								
	Tons	Iron	Phos.	Sil	Mang	Alum	Lime	Mag	Sul	Loss	Moist.
Negaunee	237,726	52.80	.090	7.00	.194	2.48	.700	.290	.014	1.80	12.00
Neg.-Maas	471,446	52.80	.088	7.50	.194	2.08	.503	.160	.016	1.33	12.00
Maas Spec.	53,100	52.80	.070	7.50	.180	2.00	.520	.160	.200	1.10	12.50

NEGAUNEE MINE
ANNUAL REPORT
YEAR 1946

4. ESTIMATE OF ORE RESERVES: (CONT.)

c. Estimated Analysis: (Cont.)

The Negaunee Ore includes all ore from the Negaunee Lease and the South Shore Right of Way; the Negaunee-Maas Ore includes Parcels No. 1, 2 and 3, otherwise known as the Maas Strip, the North 1/3 and North 1/6 Rights of Way.

Ore in Stock - Average Natural Analysis

Grade	Tons	Iron	Phos	Sil	Mang	Alum	Lime	Mag	Sul	Loss	Moist.
Negaunee	32,523	51.682	.083	8.850	.132	2.789	.326	.150	.019	1.394	11.7
Neg.-Maas	70,040	52.601	.075	7.689	.132	2.880	.299	.141	.015	1.374	11.9
Total	102,563										

5. LABOR AND WAGES:

a. Comments:

There were 264 employees on December 31st, 1946 as compared with 313 on the same date in 1945, a decrease of 49 men. These figures are derived from the labor statement and include statistical men. They would not necessarily agree with the average actual number of men employed during the year. The reduction in the working force was larger than in the preceding year due to a more rapid depletion of mining places as well as the resulting surplus of common labor. During the year 28 men were transferred to the Mather Mine, 18 men left the employ of the company, 2 men were drafted, 2 men died, 1 man was retired and 1 man was discharged. During the same period 26 servicemen were rehired and for the most part given their old jobs. Where it was not possible to rehire these men they were transferred directly to the Mather Mine.

The labor strike of the United Steel Workers or CIO Union had only limited effect with reference to the loss of employees. During May and June there were 8 men accredited with having left the mine and the employ of the company; in some instances these men later returned seeking their old jobs back. Despite the relatively high-spirited conflicts which resulted during the idle period, the general attitude of the returning men was good. In this respect it was quite evident that the majority of the employees did not wish to strike and they all felt the loss in wages very keenly. Both before as well as after the strike, relations with the Union and the supervisory force have been very satisfactory. One grievance resulted from insubordination where an employee refused to obey orders and was given a three-day layoff. This case occurred immediately after the return to work on May 22nd and since that time the general relationship between management and employees has been excellent. This record continues to show that employees find that any complaint or request can be given more immediate attention through the mining captain or superintendent rather than going through the union grievance procedure.

As noted in the following table there was a considerable increase in the average wages per day of both surface and underground employees. In lieu of the 18-1/2 cents per hour increase, surface wages increased $1.71 per day and underground wages $1.47 per day, resulting in an average overall increase of $1.52 per day. The larger surface wages figure is due to statistical adjustments from shops and other mines; it is also the result of less common surface labor as compared with more skilled labor.

NEGAUNEE MINE
ANNUAL REPORT
YEAR 1946

5. LABOR AND WAGES: (CONT.)

b. Comparative Statement of Wages and Product:

	1946	1945	Increase	Decrease
Product	416,021	654,447		238,426
No. Shifts & Hours	1-8 4	1-8 13		9
	2-8 214	2-8 288		74
Average No. Men Working:				
Surface	55	63		8
Underground	209-1/4	250		40-3/4
Total	264-1/4	313		48-3/4
Average Wages Per Day:				
Surface	9.27	7.56	1.71	
Underground	10.60	9.13	1.47	
Total	10.31	8.79	1.52	
Average Wages Per Month:				
Surface	251.70	184.63	67.07	
Underground	278.40	205.06	73.34	
Total	272.90	200.95	71.95	
Product Per Man Per Day:				
Surface	32.77	35.42		2.65
Underground	8.90	9.71		.81
Total	7.01	7.62		.61
Labor Cost Per Ton:				
Surface	.283	.213	.070	
Underground	1.190	.940	.250	
Total	1.473	1.153	.320	
Average Product Mining:				
Stoping	27.78	26.73	1.05	
Developing in Ore	8.35	7.59	.76	
Tot al	25.38	25.69		.31
Average Wages Contract Labor	11.02	9.54	1.48	
Total Number of Days:				
Surface	12,695	18,475-1/4		5,780-1/4
Underground	46,737	67,367-3/4		20,630-3/4
Total	59,432	85,843		26,411
Amount for Labor:				
Surface	117,669.29	139,583.84*		21,914.55
Underground	495,282.91	615,181.89		119,898.98
Total	612,952.20	754,765.73		141,813.53

*Including Retroactive Wages.

Average Wages Per Month as Per Labor Statement - Less Captains & Clerks			
Surface	255.40	170.64	84.76
Underground	278.24	203.65	64.59
Total	273.82	197.00	76.82

Proportion of Surface to Underground Men:

1946 1 to 3.80

1945 1 to 3.97

NEGAUNEE MINE
ANNUAL REPORT
YEAR 1946

6. SURFACE:

a. Buildings and Repairs:

Withethe exception of an addition to the ore transfer building there were no new buildings erected on the mine property. The barn which was located on the extension of Lincoln Street northwest of the mine was sold and dismantled during the latter part of the year. Formerly this building had been used for storage and due to the enlarging of the caved area, settlement had begun to show in and near the building. With reference to the remaining buildings, the usual repairs and maintenance were made, especially with respect to windows and doors, which in some cases had become badly rotted.

b. Fences:

All fences which surround the mine property or enclose the caved area north of the mine were inspected periodically and repairs were made where necessary.

c. Tracks and Roads:

All tracks and roads near the mine were maintained during the year. Due to several extremely heavy rain storms a large amount of resurfacing and drainage by ditches and launders was done. A part of the road between the mine office and the No. 2 Shaft was relocated south of the caved area. This road was regravelled and graded to allow a better run-off of rain water.

d. Stockpiles:

During the past few years there has been only a limited amount of ore remaining in stock after the end of shipping season. During 1946 shipments from the stockpile were delayed due to the strike but got underway on May 27th. During August and September there were little or no stockpile shipments and as the cold weather approached stockpile shipments were greatly increased. Lake navigation was closed early in December with shipments stopping December 3rd.

d-1. Ore and Rock Trestles:

The usual repairs and maintenance were made to the permanent steel ore trestles and the wood rock trestle to the west, east and northeast of the shaft. The return 5/8" cable which was formerly located between the box girders of the west trestle was moved into a position two feet south of the track and at the same elevation. In this place the cable is supported on 12-inch sheaves at intervals of 50 feet and are accessible for replacement and oiling at all times.

e. Shaft House:

The shaft house was kept in repair throughout the entire year with the usual pocket plates and skip dumps receiving most of the attention. In July the wood casing which surrounds the cage road to the landing, a distance of approximately 35 feet, was replaced by steel plate, both as a precaution against fire as well as the fact that it was beginning to deteriorate. Following this work a small amount of re-enforcing of the steel members was done in and near the skip dumps where the side plates had become worn and loosened.

NEGAUNEE MINE
ANNUAL REPORT
YEAR 1946

6. SURFACE: (CONT.)

f. Water Supply:

The cost of water purchased from the City of Negaunee and used at the mine for the last four years is as follows:

	1946	1945	1944	1943
1st Quarter	99.04	212.44	318.00	496.85
2nd Quarter	142.23	306.94	352.65	389.82
3rd Quarter	275.44	398.85	483.90	678.64
4th Quarter	228.75	145.24	357.90	407.74
Total	745.46	1,063.47	1,512.45	1,973.05
Product - Tons	416,021	654,447	757,677	954,990
Cost Per Ton	.001792	.001409	.001996	.002066

g. Grounds:

The grounds surrounding the mine office and engine house were kept clean and in good condition throughout the year. The shrubbery was trimmed and in some cases thinned out where appearance required. At the time when there was some resurfacing and grading of the roads a general clean-up was made.

h. District Sawmill Plant:

The sawmill, located at the west end of the timber yard, was in operation intermittently throughout 1946. During June, July, August and September a large amount of ties, hardwood sills and oak logs were cut for use at the various company properties. Probably the largest single item was that of ties, which are in continuous demand. In October approximately 500 pieces of large-sized hardwood timber were delivered to the sawmill for framing. This timber will be used in mining at the Athens Mine and requires a considerable amount of work to cut into the proper lengths and sizes. During the year the total labor cost of operating the sawmill amounted to about $3,000.00, with supplies amounting to $500.00. These figures are somewhat lower than in preceding years due to the idle period occasioned by the strike.

7. UNDERGROUND:

a. Shaft Sinking:

There was no shaft sinking during 1946.

b. Development:

The comparative figures in the total amount of development for the past two years show only a slight increase in 1946. The following table gives a comparison of this development work in ore and rock.

	Drifting		Raising		Grand
Year	Ore	Rock	Ore	Rock	Total
1946	2,048'	1,178'	992'	526'	4,744'
1945	1,449'	1,497'	987'	330'	4,263

NEGAUNEE MINE
ANNUAL REPORT
YEAR 1946

7. UNDERGROUND: (CONT.)

b. Development: (Cont.)

The total development footage falls into three classes. First, approximately 60% of the footage was used in developing and exploring the southwest stoping area. Second, 20% of the footage developed known ore located in the Maas Area where the southwest end was opened to mining in the latter part of 1946. Third, the remaining 20% was necessary to maintain traveling and ventilation connections with the 13th Level airways as mining continued downward toward the 14th Level elevation.

It might be added that the preceding footage figures are not strictly confined to development, but include all drifting and raising which is paid for on the footage basis. Frequently this work involves drifting through dikes or testing areas adjacent to dikes. The ventilation work also is not strictly development, but likewise is necessary for the general improvement of mining conditions.

b-1. Rock Development:

The following table gives a summary of rock drifting and raising in 1946 and 1945:

Location	Drifting	Raising	Total 1946
9th Level	18		18
360' Sub-level	172		172
170' Sub-level	49	25	74
150' Sub-level	168	60	228
140' Sub-level	153	215	368
125' Sub-level	411	68	479
115' Sub-level	116	64	180
85' Sub-level	45		45
90' Sub-level	36	29	65
14th Level	10	65	75
Total 1946	1,178	526	1,704
Total 1945	1,497	330	1,827

There was only a slight decrease in rock drifting and raising during the year. Somewhat over 50% of this rock work consisted of the driving of primary and secondary transfers into the footwall to make available for stoping operations the ore lying immediately above. Wherever possible these transfers are in footwall material or lean ore, and with a portion of the lower development in the same material. The balance of the footage was carried on in driving ventilation drifts and raises. The outstanding work for the year was the driving of the 172-foot, inclined rock drift on and above the 360' Sublevel which connected the 11th and 12th Levels as a part of the main airway from the 9th Level.

b-2. Ore Development:

The following table gives a summary of ore drifting and raising in 1946 and 1945:

Location	Drifting	Raising	Total 1946
170' Sub-level	64	44	108
140' Sub-level	668	272	940
125' Sub-level	328	190	518
115' Sub-level	175	142	317
85' Sub-level	336	319	655
90' Sub-level	197	25	222
14th Level	280	&&&c	280
Total 1946	2,048	992	3,040
Total 1945	1,449	987	2,436

NEGAUNEE MINE
ANNUAL REPORT
YEAR 1946

7. UNDERGROUND: (CONT.)

b-2. Ore Development: (Cont.)

As indicated by the preceding table, there was an increase in ore development during 1946. All this work was located between the 140' Sub-level and the 14th Level. Approximately 85% was the result of exploration and development carried on in the stoping area south of the main dike and running about east and west a distance of 800 feet. The remaining 15% was included in the work of driving a new 1450 Crosscut into the southwest portion of the Maas Area. This work was carried on in the latter part of 1946 and will open to mining this 40-foot ore pillar above the 14th Level. Inasmuch as all known ore bodies are well explored, development of only a secondary nature is necessary and will show a sharp decrease in 1947.

c. Stoping:

(1) General:

The product for the year was obtained from the three main leases, viz., the Negaunee Lease, South Shore Right of Way, and Maas Area, the latter being divided into Parcels 1, 2 and 3. The percentage of product from the Maas Lease was slightly lower than in 1945 and it is quite evident that in the next year or two production from the Maas Area will greatly increase with a corresponding decrease in production from the Negaunee Lease.

In general the product was mined from the same areas as in previous years, namely the No. 1 Shaft Pillar above the 9th Level, the main ore body above the 14th Level on the north and east footwalls and the stoping area south of the main dike along the south footwall.

The sub-levels on which mining was carried on during the year above the 9th Level include the 690' and 673' Subs. As previously mentioned, this mining is located in the No. 1 Shaft Pillar and is the last available ore above the 9th Level. The greatest proportion of mining was carried on between the 13th and 14th Levels on all sub-level intervals listed as follows: 195', 185', 170', 160', 150', 140', 125', 115', 100' and 90' Sub-levels. Approximately 80% of the product resulted from mining operations on the 150' and 140' Sub-levels, where an average of 16 contracts carried on mining operationd during the year. This condition again reflects the general trend of concentration of mining operations during recent years in a gradually smaller mining area.

The locations of mining contracts in 1946 and 1945 are listed below:

	1946	1945
	3 above 9th Level	4 above 9th Level
	0 above 13th Level	1 above 13th Level
	24 above 14th Level	25 above 14th Level
Total	27	30

It will be noted by the preceding table that there were three less contracts working at the end of the year as compared with 1945. On the average 17 contracts were carrying on regular mining operations while 5 contracts were developing, three contracts were making repairs to main level drifts or raises while the remaining two contracts were cutting out on new sub-levels preparatory to mining. In general this compares favorably with the preceding year, although it is quite evident that as the main mining sub-levels approach the 14th Level considerably more repair work will be required by the mining contracts. The following table shows a comparison of the number of miners in active work during the past two years:

NEGAUNEE MINE
ANNUAL REPORT
YEAR 1946

7. UNDERGROUND: (CONT.)

c. Stoping: (Cont.)

(1) General: (Cont.)

	1946	No. Miners	1945	No. Miners
Two-shift Contracts	26	104	28	112
One-shift Contracts	1	2	2	4
Total Contracts and Miners	27	106	30	116

In December, 1946 there was a considerable increase in Company Account miners inasmuch as two contracts completed mining in there particular areas, reducing the active contracts from 27 to 25. On the average the number of Company Account miners was greater in 1946 due once more to the ever-growing amount of repair work on and above the 14th Level. Possibly a second reason for the need of more Company Account miners is the large number of ventilation drifts which continue to deliver air from the 13th Level to the active sub-levels. These openings require constant repair and it is very evident that general ventilation conditions can greatly increase or decrease the efficiency of mining operations.

(2) Detail of Stoping:

Subs Above the 9th Level

Negaunee Lease - No. 1 Shaft Pillar

This ore area was mined on two different elevations during 1946. Early in the year four contracts were located in this ore body and near the middle of the year the number was reduced to three and it will likely remain at this figure until mining operations have been completed. This pillar is located adjacent to the east footwall approximately 200 feet northwest of the old original No. 1 Shaft. Its actual size is approximately 300 feet in length by 150 feet in width, the latter figure depending on the general dip of the lean ore footwall. The northwest boundary of this mining area is adjacent to old workings and along the old original main dividing dike which served as a mining limit to the No. 1 Shaft supporting Pillar.

Early in January mining operations were well underway on the 690' Sub-level from Raises 901, 901-A, 908 and 910. Three of these raises are located on the south side of the 9th Level drift and at the 690' elevation the footwall intersects the raise. It was therefore quite evident that subsequent mining would of necessity be carried on from raises to the north. In August Raises 900 and 909 were repaired and put into service on the 673' Sub-level. Mining operations were started to the northwest along the dividing dike and old workings. In several cases old stope wood was encountered but for the most part mining operations were very favorable.

In December the sub-level was nearing the completed stage and the three mining contracts were removing the final pillars which remain near the various active raises. No. 24 Contract advanced two slices west of the raise to old workings and thereafter completed one slice east to No. 901 Raise to serve as a ventilation opening. No. 43 Contract advanced two slices to the footwall south of No. 909 Raise and thereafter mined two slices west of the raise adjacent to old workings. Near the end of the month two small pillars remained to the north and south of the raise. No. 12 Contract advanced one long slice and started a second west of No. 908 Raise. During the progress of these workings considerable stope wood was encountered which will likely continue for at least the next slice remaining before completing mining operations on the sub-level.

NEGAUNEE MINE
ANNUAL REPORT
YEAR 1946

7. UNDERGROUND: (CONT.)

c. Stoping: (Cont.)

(2) Detail of Stoping: (Cont.)

10th, 11th, 12th, & 13th Levels

There was no ore produced or trammed on or above any of these main levels. For the most part the only activity was that of repairing and maintaining the various traveling and ventilation connections between the 9th Level and the 13th Level, a distance of approximately 400 feet.

Subs Above the 14th Level

Negaunee Mine Lease

In January three mining contracts were completing operations on the 185' Sub-level in the Negaunee Lease in the immediate central portion of the main ore body just north of the dividing dike. This area is approximately 300 feet long and 150 feet wide and is served by the 1430 and 1440 Crosscuts. Mining operations were practically completed early in February prior to the strike. Early in June the 170' Sub-level was opened and in July four contracts were engaged in mining operations. Near the end of the year it was necessary to abandon one raise due to its crushed condition and to alter general plans to allow the remaining three contracts to mine on the same elevation despite the additional territory.

In December No. 8 Contract completed two long slices east of No. 1443 Raise and thereafter commenced mining the last remaining pillar south and east of the raise. No. 7 Contract advanced three slices west of the raise to old workings and had a small pillar remaining south of the raise before the 170' Sub-level is completed.

Mining operations were started on the 150' Sub-level by two contracts in October. A portion of this area lies within the bounds of the South Shore Right of Way and Parcels 2 & 3 and is served by Raises 1480 and 1433-A, the latter being a transfer raise from a drift southwest of No. 1433 Raise on a lower elevation. The two above-mentioned raises were connected and mining operations were started north and west of No. 1480 Raise in November. In December No. 14 Contract had advanced four slices to old workings southwest of the raise in Parcels 1, 2 & 3. No. 33 Contract had advanced three slices southwest of transfer raise No. 1433-A to a mining limit.

Area Adjacent to the East Footwall

This area lies adjacent to the original dividing line between the Maas and Negaunee Mines and partially within the bounds of the South Shore Right of Way as well as the Negaunee Mine Lease. The lean ore footwall which has greatly reduced the size of this area on the 150' and 140' Sub-levels is very irregular. It is served by two raises, namely 1420 and 1433. A large jasper horse which was apparently extruded from the footwall divides these two small mining areas and has persisted irregularly for the past four sub-levels. Early in the year the two raises had been opened for mining on the 150' Sub-level. Air connections and traveling drifts were completed just before the idle period caused by the strike. In June, after minor repairs had been completed, operations were resumed and mining was carried on southwest, adjacent to the above-mentioned jasper horse. This sub-level was completed in September and the two contracts moved to the 140' Sub-level where operations were resumed.

7. UNDERGROUND: (CONT.)

c. Stoping: (Cont.)

(2) Detail of Stoping: (Cont.)

After driving the necessary traveling and ventilation drifts, mining operations were started, also adjacent to the jasper horse and continued throughout the end of the year. Indications are that all mining in the vicinity of Raises No. 1420 was completed by these operations, inasmuch as the raise enters the lean ore footwall, causing a reduction in the size of the ore body of approximately 60 feet. In the area near Raise No. 1433 as previously mentioned, a transfer was driven to the southwest where it is necessary to mine a small area on the sub-level above in the vicinity of the raise which was abandoned due to crushing. Mining was completed from the transfer in December and operations were then resumed on the 140' Sub-level from No. 1433 Raise.

Sub-level Stoping Area South of Main Dike

The sub-level stoping area is located south of the main Negaunee ore body and adjacent to the main dividing dike. The ore is not continuous and the areas generally have no particular sequence or size. The enrichment has for the most part been along dikes or faults which are numerous in this area. During 1946 eight stopes of variable sizes have been mined in a territory located directly above the 1470 Crosscut and covering a distance of approximately 800 feet. In general this area has been exceptionally well adapted to stoping operations due to the extremely hard back or capping as well as the intermittent mined ore bodies resulting in stopes supported or surrounded by solid slate and jasper pillars. The area has had, however, the disadvantage of having the ore bodies so irregular that several stopes have been supposedly completed only to find a small ore stringer leading to an enlarged portion of ore which can likewise be stoped. Frequently this requires additional development including some rock work and at times a second transfer.

In August development work was started to open a large stope which extends from the 125' Sub-level to above the 195' Sub-level (13th Level). The upper portion of this was originally intersected by the 13th Level development and remained unmined to allow the level airways to remain intact. With the ventilation layout continually changing this ore body has now been made available. The development was started by putting No. 1472 Raise up to the 125' Sub-level where the contact was intersected at the lowest point in the ore trough. A transfer approximately 90 feet long was inclined to the northeast in the bottom of the trough and mill raises were extended from the south side. It might be added that this is the last known ore body that can be stoped and from all appearances it should be one of the largest. In December No. 44 Contract continued developing the stope above the transfer from No. 1472 Raise. The end mining mill raise was extended to a point 36 feet above the 195' Sub-lev el and the regular cross drift from the traveling raise was extended to the mining raise at the extreme northeast end of the ore body. Stoping operations will likely be started early in January, although considerably more development work will be required to the north and southwest.

In January, 1946 stoping operations were in progress above No. 1473 Raise. This stope is located northeast of a cross dike on the east slate footwall. The capping is composed of hard jasper and dips to the northwest. The actual stoping height near the final stages of mining was only about 20 feet and by the first of February this operation was completed after the lean ore capping was located to the north and west.

NEGAUNEE MINE
ANNUAL REPORT
YEAR 1946

7. UNDERGROUND: (CONT.)

c. Stoping: (Cont.)

(2) Detail of Stoping: (Cont.)

On the resumption of mining operations in May some development and stoping was started near No. 1474 Raise above a short transfer which was driven to the northwest late in 1945. At that time it was thought advisable to work out another portion of the area before continuing stoping operations. This pillar is located above and northwest of the raise with the largest area on the 160' Sub-level. At this point the jasper capping dips to the northwest, reducing the actual mining height to less than 20 feet above the transfer on the 140' Sub-level. Actually the end of the transfer is in the jasper capping with the result that only a limited tonnage was developed and mined. The stope is bounded on the southwest and northeast by the main dividing dikes which intersect the stope area dividing it into six ore pillars, of which four have now been mined, one in the process of mining (as described above) and the sixth unmined at that time.

Early in August the final stages of stoping were completed northwest of No. 1474 Raise and immediately thereafter development work was started southwest of No. 1475 Raise on the 140' Sub-level. At that time it was thought that only a limited amount of ore could be developed in this direction, however, in September an ore pillar approximately 90 feet by 50 feet was developed and stoping operations were underway soon after. This area is bounded on the north by the dike, to the east by the original hard ore stope which was mined in 1944, and to the south and west the footwall was encountered with jasper being contacted at higher elevations. By November it was necessary to carry on additional development at higher elevations in the footwall to the south with the result that a secondary transfer was driven.

In December a number of small exploratory drifts and raises had been driven indicating that a considerable amount of lean ore and jasper persisted from east to west along and above the slate footwall. In many respects this is beneficial, inasmuch as it will allow an 80 foot ore pillar, which is now located immediately above No. 1475 Raise to be undercut and mined. The jasper pillar on the south will to a large degree support the back of the stope while the final stages of mining are being completed. It might be added that the percentage of extraction from this mining area is well in excess of 90% and generally speaking the general mining conditions have been exceptionally good.

After resuming mining operations in June a small ore pillar which had been located in the vicinity of No. 1477 Raise above the 115' Sub-level was brought into operation. This pillar had a vertical height of approximately 41 feet, with the ore in plan being circular about 50 feet in diameter. The one big disadvantage in mining was the fact that the double cribbed raise which originally located the ore was put up through the central portion. The result was that the raise had to be dismantled before mining operations could be started. A short transfer was driven to the south from No. 1477 Raise on the 115' Sub-level with two mill raises extending upwards to the cribbed raise 20 feet above. The traveling raise and drifts were in rock to the north and the cribbed raise was dismantled in 20 foot stages. In order to prevent a dangerous overhang as the raise was dismantled, it was necessary to carry on stoping operations simultaneously with this work. In September it was found that additional ore had made to the west with the result that it was necessary to drive a second transfer south and west of the raise to develop this ore. The general pitch of the jasper capping was to the northwest

7. UNDERGROUND: (CONT.)

c. Stoping: (Cont.)

(2) Detail of Stoping: (Cont.)

and the stoping height was reduced in this direction to approximately 25 feet. This second stope was then completed and indications were that the ore made still further to the west although the vertical height was considerably reduced. In October development was carried on from a drift south of No. 1479 Raise on the 115' Sub-level. Three mill raises were extended to the ore and stoping operations were resumed. In December stoping operations were completed with the actual stope measuring 120 feet by 80 feet with a variable height between 50 and 15 feet.

During the original development of the 14th Level the 1470 Crosscut was extended to the southwest, almost paralleling the dividing line between the Maas and Negaunee Mines. During the driving of this drift some ore was encountered which was apparently an upward extension of a small ore body which had been mined at lower elevations in the Maas Mine. In January, 1946, further exploratory work was carried on by driving two drifts just 10 feet above the floor of the main level on the 90' Sub-level elevation. The drifts were driven to the northwest approximately 60 feet, being located on either side of an old exploratory raise, No. 1478. The drifts encountered the main dividing dike and for the most part the results were disappointing. Banded ore and lean ore was encountered and the transfer to the west was temporarily stopped. However, further development continued in the second transfer to the east and eventually a stope approximately 50 feet square was mined. Later in the year further explorations were carried on to the south where a limited tonnage of marginal ore was stoped along the south footwall. Here again the ore was very banded and mixed and only a limited amount of this material could be included with the regular product. By the end of 1946 two stopes were in operation in this long stoping territory, while a third was being developed. These three operations will complete stoping in the Negaunee Mine with respect to the present known ore body. Generally speaking the area has been very well adapted to sub-level stoping and by the use of this method a number of additional small ore bodies were located which may well have been lost had another type of mining method been used.

South Shore Right of Way

Area Adjacent to Maas Boundary

For the past several years mining operations have been carried on above the 1460 Crosscut in the vicinity of No. 1463 and 1464 Raises. This area is bounded on the southeast by the dividing dike, on the northeast by a small cross dike and on the west and southwest by old workings of the Maas Mine. The area lies almost entirely within the bounds of the South Shore Right of Way, with the result that it has been treated under this heading and segregated from other operations. Early in the year mining operations were being completed on the 125' Sub-level north and east of No. 1463 Raise. After the strike period some exploration work was done north of the crossdike but for the most part lean ore jasper was encountered.

In August the 115' Sub-level was opened and mining was carried on adjacent to the Maas Mine workings and along the main dike to the south.

In December two slices were completed west of No. 1463 Raise and No. 26 Contract continued slicing to the north where a considerable area remains.

NEGAUNEE MINE
ANNUAL REPORT
YEAR 1946

7. UNDERGROUND: (CONT.)

c. Stoping: (Cont.)

(2) Detail of Stoping: (Cont.)

Maas Area Lease

Area Adjacent to Maas Mine on North Footwall

This lease comprises an area approximately 700 feet by 250 feet which is served by the 1410, 1420, 1430, 1440, 1450 and 1480 Crosscuts. During the year there was an average of 12 contracts engaged in mining with the greatest concentration along the north footwall on the 150' and 140' Sub-levels. In January 90% of the 150' Sub-level had been mined with the remaining 10% distributed in smaller pillars throughout the entire length of the Maas Lease. Early in February, prior to the strike, practically all mining had been completed and during the idle period the supervisory force carried on much needed repairs in the various crosscuts which serve this lease. After work was resumed late in May, considerable additional repair work was necessary before actual mining operations could be started. Approximately 6 contracts commenced cutting out raises on new sub-levels and by July mining operations in the Maas Lease were in full scale production on the 140' Sub-level.

General mining conditions have always been very favorable in this lease, there being practically no water to contend with and the ore is very soft, although there is considerable pressure resulting from rapid mining operations. The north footwall pitches very flatly to the southwest and for each sub-level of 12 to 13 feet the area is reduced in size by approximately 60 feet. Near the end of the year the 1410 or footwall crosscut was abandoned inasmuch as the mining from all raises had been completed. It was, however, maintained for ventilation and timber storage.

In general, mining operations on the 140' Sub-level were favorable. The north portion of the lease was occupied by 8 contracts. Late in the year, as a result of the excessive pressure in the 1420 Crosscut, the general ventilation system was revised to use the above mentioned idle 1410 Crosscut as the main exhaust airway. Near the end of the year approximately 95% of the sub-level was mined and plans were in progress to open the 125' Sub-level, which is approximately 50 feet above the 14th Level.

In December Contracts 28, 45 and 22 completed the mining of several small pillars near the various raises and after minor repairs the 125' Sub-level will be opened early in January. Contract 23, which had formerly been located at No. 1424 Raise, was temporarily moved to allow a new cribbed raise, No. 1439, to be completed from the 1430 Crosscut. As previously mentioned, constant repairs have been necessary in the 1420 Crosscut and it is quite evident that there will be some interruption of regular mining operations during the remaining life of the mine. Contract 36 at No. 1438 Raise, completed mining on the 140' Sub-level early in December and during the remainder of the month timbered over the raise on the 125' Sub-level. Contracts 37, 15 and 30, which are located in the very central portion of the Maas Lease, were also mining the pillars in the vicinity of Raises 1436, 1435 and 1434.

In the south portion of the Maas Area the actual ore pillar above the 14th Level is about 75 feet high. This varies considerably as mining has progressed to the northwest. The area is badly cut up with old drifts and raises and is extremely heavy as far as being able to complete the development drifts and raise openings is concerned. The 1480 Crosscut, which was driven across the Maas Lease in a northwesterly direction in 1945, has

7. UNDERGROUND: (CONT.)

c. Stoping: (Cont.)

(2) Detail of Stoping: (Cont.)

required constant repairs and only one mining contract has been in continuous operation in this locality. No. 1481 Raise was extended to the 115' Sub-level late in 1945. Mining operations were immediately started and it was found that the height of ore was not uniform; however, in July while mining the south portion of the area served by this raise conditions greatly improved. In October all available ore had been mined and operations were started in cutting the 100' Sub-level.

In December No. 9 Contract completed two slices and started a third south of No. 1481 Raise to the original Negaunee-Maas Boundary line. Slicing was continued to the west where a comparatively large area remains.

In the extreme southern end of the Maas Lease a new crosscut was started in September from the original 1450 drift. This crosscut was directed to the northeast and parallel to the old original 1450 drift which was abandoned in 1945. The new drift was driven approximately 150 feet parallel to the footwall and two raise locations were made at a point approximately in the center of the length of the drift, allowing sufficient tail room for tramming. Due to the extreme pressure it was decided to use the sub-level caving method in place of top slicing which would require considerably less development and mining could be carried on much more rapidly.

In December Contracts 21 and 25 commenced developing for the sub-level caving system. Contract 25 completed the cutting of the raise location on top of and just above the crosscut timber. Contract 21, located at the second raise 20 feet to the northeast, had completed the cutout and was drifting to the northeast where a connection will be made with the 1480 Crosscut for ventilation. Early in January the two contracts will drift to the northwest, drawing the pillar and retreating to the southeast.

d. Timbering:

As a result of the work stoppage due to the strike the total cost of timbering cannot be compared. A considerable amount of timbering and repairs were made during the strike by the supervisory force and it was only through the efforts of these men that many of the mine openings were maintained. The gradual pressure was not felt as much up on the mining sub-levels as it was on the main haulage levels where a considerable portion of the 14th Level lies within the pressure area.

Immediately following the strike there was a concentration of repair work and timbering throughout the entire mine. This work continued through June and in a few extreme cases the effect of the strike were felt for several additional months. This was particularly true where raises above the 14th Level collapsed, requiring considerable time to repair the old ones or drive new raises.

Another factor effecting both the cost as well as the amount of time required in timbering is the decrease in distance between the active mining sub-level (125' elevation) and the 14th Level (75' elevation). A certain proportion of the pressure which is normally taken on the active sub-level is now diverted to the main level drifts and constant repairs are necessary.

In comparing 1946 with the previous year, there was not a great difference in the amount of timbering as compared with mining, this work being carried on

NEGAUNEE MINE
ANNUAL REPORT
YEAR 1946

7. UNDERGROUND: (CONT.)

d. Timbering: (Cont.)

by the contract miners. In 1945, 27% of the miners' time was devoted to timbering or Company Account work, 73% to active mining operations. In 1946, 30% of the time was taken up in timbering while the remaining 70% was devoted to productive work. These figures do not of course include the time that the supervisory force spent in timbering during the strike period.

During 1946 and with the relief from wartime restrictions it was possible to again treat timber at the company treating plant located at the Maas Mine. As a result, all traveling and ventilation ways between the 13th and 9th Levels were retimbered where necessary, using treated timber. In various parts of these drifts it was possible to use 60# rail sets and somewhat over 100 sets were installed during the year.

NEGAUNEE MINE
ANNUAL REPORT
YEAR 1946

7. UNDERGROUND: (CONT.)

d. Timbering: (Cont.)

Statement of Timber Used:

	Lineal Feet	Avg. Price Per Foot	Amount 1946	Amount 1945
6" to 8" Cribbing	41,993	.0546	2,291.13	3,892.07
8" Stulls	50,616	.0939	4,751.12	3,329.21
10" "	68,458	.1549	10,604.09	9,064.01
12" " & Over	55,124	.2132	11,752.29	17,280.34
Total 1946	216,191	.1360	29,398.63	33,565.63
Lagging - 7 ft.	970,167	.0142	13,775.36	25,966.34
Poles - 9-1/2 ft.	648,198	.0217	14,090.65	32,630.13
Total 1946	1,618,365	.0172	27,866.01	58,596.47
H Beams - 10' & 12'	2,460	.2989	735.34	----
Wire Fencing - Feet	-----		-----	104.40
Grand Total 1946			57,999.98	92,266.50

	1946	1945
Product - Tons	416,021	654,447
Feet Timber Per Ton of Ore	.520	.395
Feet Lagging Per Ton of Ore	2.332	2.880
Feet Poles Per Ton of Ore	1.558	2.355
Feet Lagging Per Foot of Timber	4,488	7.296
Feet H Beams Per Ton of Ore	.0059	----
Feet Wire Fencing Per Ton of Ore	----	.0025
Cost Per Ton for Timber	.0707	.0513
Cost Per Ton for Lagging	.0331	.0397
Cost Per Ton for Poles	.0338	.0498
Cost Per Ton for H Beams	.0018	----
Cost Per Ton for Wire Fencing	----	.0001
Total Cost Per Ton	.1394	.1409

Total Cost for Timber, Lagging, Poles, Etc.:

Year	Product	Amount	Cost Per Ton
1946	416,021	57,999.98	.1394
1945	654,447	92,266.50	.1409
1944	757,677	108,489.21	.1431
1943	954,990	129,718.86	.1358
1942	1,106,694	123,588.82	.1117
1941	1,033,220	96,802.32	.0937
1940	865,689	79,331.40	.0916

NEGAUNEE MINE
ANNUAL REPORT
YEAR 1946

7. UNDERGROUND: (CONT.)

e. Drifting and Raising:

There was only a comparatively small amount of main level drifting and raising carried on during 1946 inasmuch as all ore areas in the Negaunee Mine have been explored and developed. It is likely that the amount of drifting and raising will continue to show a reduction.

It should be noted that this subject is discussed in detail under the development heading.

f. Explosives, Drilling and Blasting:

The total cost of all explosives decreased considerably during the year due to the idle strike period with a corresponding lower production. The total cost of all explosives in 1946 amounted to 6.37¢ per ton as compared with 6.0¢ in 1945. This can be attributed to a general price increase in September of approximately 16% on all explosives. As a result of this increase we were advised to change from Gelamite #1 powder to a Hercomite XX powder at the suggestion of the Hercules Powder Company. The Hercomite was less expensive and carried practically the same strength. The powder itself was somewhat more granular and could not be used in extremely wet places. Generally speaking it was not liked as well due to this feature; however, using it in combination with the heavy, waxed paper tamping cartridges it worked very satisfactorily.

As shown in the following table there was a slight reduction in the fractional pounds of powder per ton of ore. This may well be the result of a slightly greater proportion of the product coming from the stoping areas where there is a greater tonnage of ore mined per pound of powder used.

In 1946 there were 88 inspections made on an average of 26 mining contracts of four men each. These reports are a check on proper procedures and instruction with respect to the use and handling of explosives. Due to the idle period as well as a general disruption of mining operations these inspections were not as frequent as in past years. There will be a definite improvement in 1947.

With the gradual reduction of mining contracts there has been a greater accumulation of mining equipment, in particular, pneumatic drills. With the large surplus it has been possible to scrap those machines where the cost of repairs was excessive. This condition was true of all pneumatic drill machines, whether wet or dry. There were no new pneumatic drills purchased in 1946.

With reference to auger steel, there were no changes during 1946. Some improvement has been noted in the quality, although the heavy breakage and high cost of this type of drill steel continues to be a major problem in soft ore iron mining.

NEGAUNEE MINE
ANNUAL REPORT
YEAR 1946

7. UNDERGROUND: (CONT.)

f. Explosives, Drilling and Blasting: (Cont.)

The following statement gives a comparison of powder costs, etc., for the past ten years:

Year	Cost per lb. For Powder	Lbs. Powder per Tons of Ore	Cost per Ton For Powder	Cost per Ton Fuse & Caps	Total Cost
1946	.1245	.4222	.0526	.0111	.0637
1945	.1150	.4346	.0500	.0100	.0600
1944	.1150	.4723	.0543	.0107	.0650
1943	.1150	.4918	.0566	.0115	.0681
1942	.1150	.4788	.0551	.0117	.0668
1941	.1150	.4792	.0551	.0118	.0669
1940	.1151	.4485	.0516	.0111	.0627
1939	.1176	.4584	.0539	.0113	.0652
1938	.1225	.4320	.0530	.0102	.0632
1937	.1194	.4270	.0510	.0110	.0620

Statement of Explosives Used: (Ore Development & Stoping)

	Quantity	Average Price	Amount 1946	Amount 1945
Gelamite #1	45,950	11.91	5,470.75	31,435.24
Hercomite XX	129,700	12.65	16,404.25	-------
60% Gelatin	---		-------	1,276.50
Total Powder 1946	175,650	12.45	21,875.00	32,711.74
Fuse - Feet	591,220	5.69	3,362.35	4,677.69
#6 Blasting Caps	79,315	13.25	1,050.68	1,587.25
Tamping Bags	16,400	6.00	98.40	141.45
Fuse Lighters	17,500	6.75	118.16	168.80
Blasting Wire				5.37
Total Fuse, Etc. 1946			4,629.59	6,580.56
Total Cost All Explosives			26,504.59	39,292.30
Product - Tons			416,021	654,447
Pounds Powder per Ton of Ore			.4222	.4346
Cost per Ton for Powder			.0526	.0500
Cost per Ton for Fuse, Caps, Etc.			.0111	.0100
Cost per Ton for All Explosives			.0637	.0600

Sinking, Rock Development, Etc.:

Gelamite #1	5,300	12.22	647.50	1,000.50
Hercomite XX	2,500	12.88	322.00	----
60% Gelatin	2,250	13.50	303.75	----
Total Powder 1946	10,050	12.67	1,273.25	1,000.50
Fuse - Feet	29,375	5.66	166.32	120.28
#6 Blasting Caps	5,445	13.25	72.17	39.50
Total Fuse, Etc. 1946			238.49	159.78
Total Cost All Explosives 1946 Rock Development			1,511.74	1,160.28
Grand Total All Explosives Used 1946			28,016.33	40,452.58
Average Price per Pound for Powder 1946			.125	.115
Explosives Used for Stoping & Development			28,016.33	40,452.58
Explosives Used for Other Work			46.10	766.43
Total as per Cost Sheet			28,062.43	41,219.01

NEGAUNEE MINE
ANNUAL REPORT
YEAR 1946

7. UNDERGROUND: (CONT.)

g. Mining and Loading:

The two main mining methods with respect to the 1946 production continued to be top slicing and sub-level stoping. During the year approximately 17% of the production resulted from stoping operations; 83% from slicing. In some cases ore pillars were drawn from upper elevations although the amount of ore as compa red with the other two methods was relatively small.

h. Ventilation:

The general mining conditions have shown a steady improvement in the past few years, particularly with respect to ventilation, healthful conditions and productivity. It has been possible to supply each mining contract with a fresh stream of air amounting to approximately 1,000 cubic feet per minute. This amount is reduced, however, as the sub-level becomes mined out and the traveling roads are reduced in size. In addition to this the tremendous amount of timber generates considerable heat during the process of oxidation or deterioration. This heat has its effect on the movement of the ventilation air streams, particularly where the ventilation system is downcast and exhausting on lower levels. To a certain extent this condition drives the warm air down, counteracting its normal movement. Ventilation is No. 1 in general mining conditions and is directly proportional to production.

The Aerodyne Fan at the No. 2 Shaft, located at the east end of the property, was in continuous operation throughout 1946. There were no major improvements to this plant during the year. The heating plant was operated during the severe winter weather, and at times due to the extremely low temperatures was not too effective. However, the accumulation of ice in the shaft was not serious and did not impede the passing of air to any great extent.

The general underground ventilation system remained the same with one exception. A new connection was driven near the end of the year between the 12th and 11th Levels replacing a raise which had partially collapsed due to the slow deterioration of the timber cribbing. The new connection resulted in an increased flow of air due to less resistance and was a part of two independent airways in rock from the 9th Level to the 13th Level.

On December 18th a ventilation survey was made of the entire system. The report indicated that 92,000 cf.m. was being delivered by the fan to the 9th Level where the main split is located. Approximately 75,000 c.f.m is delivered to the 13th Level where a split allows a portion to go directly to the Maas Mine. The remaining air is conducted through the active workings and is allowed to enter the Maas Mine through openings on or below the 14th Level. Inasmuch as ventilation conditions are continually changing, it has been necessary to use two large booster fans to distribute the air in workings which are away from the main air streams. Approximately twelve 5,000 cubic foot auxiliary fans are also in continous service, either moving air on the sub-level or directing air from the level to the sub-level by canvas tubing. In general and despite the large number of mining contracts concentrated in the central portion of the ore body, the ventilation has been exceptionally good.

i. Pumping:

The average number of gallons pumped per minute during 1946 was 682, or approximately the exact figure as reported in the previous year.

NEGAUNEE MINE
ANNUAL REPORT
YEAR 1946

7. UNDERGROUND: (CONT.)

i. Pumping: (Cont.)

The greatest inflow of water continues to be located on and above the 9th Level, where approximately 1/2 the total volume enters the mine in the vicinity of the No. 2 Shaft. Little or no water enters the active workings, with the result that with the exception of the water pumped from the 14th Level, all the remaining water is clear. This condition is extremely important from the maintenance standpoint as far as the pumps are concerned. The distribution of the present inflow of water is as follows: 9th Level, 350 gallons; 10th Level, 150 gallons; 11th Level, 20 gallons; 12th Level 50 gallons, and 13th and 14th Levels, 110 gallons for a total of 680 gallons.

The number of gallons pumped per minute in each month of the year for the past six years are shown in the following statement:

Month	1946	1945	1944	1943	1942	1941
January	677	629	740	668	671	612
February	664	631	712	660	636	591
March	665	634	690	713	635	584
April	679	570	673	671	627	582
May	689	775	679	726	641	824*
June	731	712	787	794	659	838
July	711	720	804	843	666	602
August	695	722	805	858	662	613
September	698	717	732	849	662	612
October	680	696	654	833	667	605
November	664	685	642	860	671	629
December	632	684	634	761	675	646
Total Average	682	681	713	770	656	645

(*) Athens Mine water diverted to Negaunee Mine for months of May and June.

The following statement shows the average number of gallons pumped per minute for the past ten years:

Year	Gallons per Minute
1946	682
1945	681
1944	713
1943	770
1942	656
1941	645
1940	714
1939	1,015
1938	1,015
1937	1,069

NEGAUNEE MINE
ANNUAL REPORT
YEAR 1946

8. COST OF OPERATING:

a. Comparative Mining Costs:

	1946	1945	Increase	Decrease
Product - Tons	416,021	654,447		238,426
Underground Costs	1.622	1.414	.208	
Surface Costs	.163	.143	.020	
General Mine Expenses	.278	.273	.005	
Cost of Production	2.063	1.830	.233	
Taxes	.177	.147	.030	
Depletion & Depreciation	.033	.021	.012	
Loading & Shipping	.043	.035	.008	
Adm. & Gen. Expense	.047	.045	.002	
Miscellaneous Income	.009	.008	.001	
Total Cost	2.372	2.086	.286	
Budget Estimate	2.328	2.179		
No. of Days Operated	218	301		83
Total No. of Shifts	432	589		157
No. Shifts & Hours	1 & 2-8 hrs.	1 & 2-8 hrs.		
Average Daily Product	1,908	2,174		266

Cost of Production:

	1946	Percent	1945	Percent	Increase	Decrease
Labor	1.531	65	1.230	59	.301	
Supplies	.841	35	.856	41		.015
Total	2.372	100	2.086	100	.286	

NEGAUNEE MINE
ANNUAL REPORT
YEAR 1946

8. COST OF OPERATING: (CONT.)

b. Detailed Cost Comparison:

(1) Days an d Shifts:

Year	Days Mine Worked	Shifts & Hours	Men Employed	Total Shifts Worked
1946	218	1 & 2-8 hrs.	264	59,432
1945	301	1 & 2-8 hrs.	313	85,843
Decrease	83		49	26,411

(2) Wages:

There was an increase of 10 cents per hour effective March 21st, 1946 and an additional increase of 8-1/2 cents per hour effective May 22nd, 1946, making a total wage in crease of 18-1/2 cents per hour for the year.

(3) Comparison of Production:

Production - 1946	416,021 Tons
- 1945	654,447 Tons
Decrease	238,426 Tons

(4) Comparison of No. of Men and Wages:

Year	No. of Men	No. of Days	Amount	Rate Per Day
1946	264	59,432	612,952.20	10.31
1945	313	85,843	754,765.73	8.79
Increase				1.52
Decrease	49	26,411	141,813.53	

(5) Tons Per Man Per Day:

	1946	1945	Dacrease
Surface	32.77	35.42	2.65
Underground	8.90	9.71	.81
Total	7.01	7.62	.61

(6) Cost of Production:

1946	858,410.51	Cost Per Ton	2.063
1945	1,197,682.96	Cost Per Ton	1.830
Increase			.233
Decrease	339,272.45		

	Labor	Percent	Supplies	Percent
1946	623,774.63	72.7	234,635.88	27.3
1945	790,572.13*	66.0	407,110.83	34.0
Increase		6.7		
Decrease	166,797.50		172,474.95	6.7

* Retroactive Payroll - 53,541.62 included in 1945 costs.

NEGAUNEE MINE
ANNUAL REPORT
YEAR 1946

8. COST OF OPERATING: (CONT.)

b. Detailed Cost Comparison: (Cont.)

(7) Detail of Accounts:

		1946		1945	
	Days Per Week	6		6	
	Shifts & Hour s	1-8 4 2-8 214		1-8 13 2-8 288	
	Production - Tons	416,021		654,447	
	Average Daily Production - Tons	1,908		2,174	
	Number of Day s Worked	218		301	
	UNDERGROUND COSTS:	Amount	Per Ton	Amount	Per Ton
1	Exploring in Mine	5072.51	.013	4352.79	.006
3	Development in Rock	11637.52	.028	12042.85	.018
4	Development in Ore	25340.06	.061	17076.78	.026
5	Stoping	214308.93	.515	328342.95	.502
6	Timbering	238754.17	.574	319328.78	.488
7	Tramming	62384.12	.150	80118.40	.122
8	Ventilation	12175.91	.029	17809.97	.027
9	Pumping	26851.31	.065	36507.71	.056
10	Compressors & Air Pipes	23920.81	.057	39674.65	.061
12	Underground Superintendence	23866.92	.057	29893.26	.046
13	Cave-in	42.13	----	102.15	----
14	Maint: Comp. & Power Drills	705.22	.002	496.33	.001
15	Scraper Equipt.	12041.32	.029	17489.64	.027
16	Elec. Tram Equipt.	15472.29	.037	20835.18	.032
17	Pumping Machinery	2047.47	.005	1306.01	.002
	Total Underground Costs	674620.69	1.622	925377.45	1.414
	SURFACE COSTS:				
18	Hoisting	27241.22	.065	39785.63	.061
19	Stocking Ore	6544.74	.016	11605.87	.018
21	Dry House	10974.80	.026	13415.10	.020
22	General Surface Expense	10591.38	.026	13106.19	.020
23	Maint: Hoisting Equipt.	4354.23	.011	6257.93	.010
24	Shaft	2963.74	.007	3862.00	.006
25	Top Tram Equipt.	1194.22	.003	2242.20	.003
26	Docks, Trestles, Pockets	953.00	.002	2195.77	.003
27	Mine Buildin gs	3069.14	.007	946.55	.002
	Total Surface Costs	67886.47	.163	93417.24	.143
	GENERAL MINE EXPENSES:				
	Employees' Vacation Pay	26201.90	.063	35219.30	.054
28	Insurance	3440.50	.008	4429.93	.007
29	Mining Engineering	2642.30	.006	2935.84	.004
30	Mech. & Elec. Engineering	1667.65	.004	2359.91	.004
31	Analysis & Grading	11526.44	.028	16288.71	.025
32	Personal Injury	11955.94	.029	39448.96	.060
33	Safety Department	1677.62	.004	2000.73	.003
34	Tel. & Safety Devices	4578.03	.011	5030.54	.008
35	Local & General Welfare	2503.87	.005	3883.94	.006
36	Spec. Exp., Pensions, All.	5272.40	.013	8889.76	.014
37	Ishpeming Office	15575.21	.037	19487.72	.030
38	Soc. Sec. & Group Annuity	13235.98	.032	18609.51	.028
39	Mine Office	15625.51	.038	20303.42	.030
	Total General Mine Expenses	115903.35	.278	178888.27	.273
	COST OF PRODUCTION:	858410.51	2.063	1197682.96	1.830
	Taxes	73541.75	.177	96445.01	.147

8. COST OF OPERATING: (CONT.)

b. Detailed Cost Comparison: (Cont.)

(7) Detail of Accounts: (Cont.)

UNDERGROUND COSTS:

1. Exploring in Mine:

Increase due to exploratory work by diamond drill; depth of hole No. 52 - 265 feet; depth of hole No. 53 - 199 feet; depth of hole No. 54 - 503 feet. Total footage drilled in 1946 - 967 feet.

3. Development in Rock:

Increase due to wage increase during 1946. In 1946 there were 985 feet of rock work as compared with 1,237 feet during 1945.

4. Development in Ore:

Increase due to more development work in ore.

5. Stoping:

Expenditures decreased 114,034.02. In 1946 there were 14,365 shifts compared with 24,079-1/4 shifts in 1945 due to mine being idle on account of strike.

6. Timbering:

Expenditures decreased 80,574.61. No extraordinary charges to this account in 1946. Decrease due to mine being idle during strike period.

9. Pumping:

Expenditures decreased 9,656.40. Electric Current decreased 6,185.15.

Number of gallons pumped - 1946	279,835,161
Number of gallons pumped - 1945	357,157,529
Decrease	77,322,368
Average number of gallons per minute - 1946	682
Average number of gallons per minute - 1945	681
Decrease	1

There were 80,943,645 gallons pumped in addition to the above while the mine was idle during the strike.

10. Compressors and Air Pipes:

Expenditures decreased 8,708.22. Electric current decreased 11,519.49.

Cubic feet air compressed - 1946	518,406,000
Cubic feet air compressed - 1945	873,270,000
Decrease	354,864,000

There were 23,619,000 cubic feet of air compressed in addition to the above while the mine was idle during the strike.

11. Compressors and Power Drills:

Expenditures increased 208.89 due to repairs from lightning damage to Ingersoll-Rand Compressor.

NEGAUNEE MINE
ANNUAL REPORT
YEAR 1946

8. COST OF OPERATING: (CONT.)

b. Detailed Cost Comparison: (Cont.)

(7) Detail of Accounts: (Cont.)

15. Scrapers an d Mechanical Loaders:

Expenditures decreased 5,448.32. Wire rope used decreased 1,863.63, also less repairs to hoists and drags.

16. Electric Tram Equipment:

Expenditures decreased 5,362.89.

	1946	1945	Increase	Decrease
Generator	11.94	918.05		906.11
Locomotives	5690.54	6870.24		1179.70
Wiring	1406.47	1247.39	159.08	
Tracks	5840.36	8309.35		2468.99
Cars	2522.98	3490.15		967.17
Total	15472.29	20835.18		5362.89

17. Pumping Machinery:

Expenditures increased 741.46 due to repairs to pumps.

23. Hoisting Equipment:

Expenditures decreased 1,903.70.

	1946	1945	Increase	Decrease
Electric Hoist	1113.06	749.35	363.71	
Wire Rope	1519.38	1947.10		427.72
Skips, Cages & Skip Roads	1721.79	3561.48		1839.69
Total	4354.23	6257.93		1903.70

25. Top Tram Equipment:

Expenditures decreased 1,047.98.

	1946	1945	Decrease
Engines & Motors	16.26	246.73	230.47
Tracks & Cars	277.16	297.76	20.60
Wire Rope	576.16	645.40	69.24
Sheaves, Rollers, Etc.	324.64	1052.31	727.67
Total	1194.22	2242.20	1047.98

26. Docks, Trestles and Pockets:

Expenditures decreased 1,242.77. The steel stocking trestle was painted in 1945.

8. COST OF OPERATING: (CONT.)

b. Detailed Cost Comparison: (Cont.)

(7) Detail of Accounts: (Cont.)

27. Mine Buildings:

Expenditures increased 2,122.59. This was due to painting, repairs and chagges to office building, shop buildings an d dry house.

	1946	1945	Increase	Decrease
Office	1457.57	68.97	1388.60	
Warehouse		20.43		20.43
Shops	333.12	91.10	242.02	
Shaft House	147.92	118.38	29.54	
Engine House	212.22	33.88	178.34	
Boiler House		140.17		140.17
Dry House	467.01	51.88	415.13	
Coal Dock & Trestle		58.76		58.76
Timber Tunnel	63.16	113.05		49.89
Miscellaneous	388.14	249.93	138.21	
Total	3069.14	946.55	2122.59	

GENERAL MINE EXPENSES:

Employees' Vacation Pay:

Amount charged to operating was 26,201.90; amount charged to idle expense 7,520.00, making a total of 33,721.90, a decrease of 1,497.40. Employees with a record of five or more years of continuous service were eligible for two weeks' vacation pay and employees with one year or more of continuous service were eligible for one week's vacation pay. Employees were paid for 48 hours per week.

28. Insurance:

	1946	1945	Decrease
Property	1452.80	1922.77	469.97
Group, Health & Life	1578.82	1975.20	396.38
Group Annuity	469.00	934.27	465.27
Catastrophe	408.88	531.96	123.08
Total	3909.50	5364.20	1454.70

31. Analysis and Grading:

	1946	1945	Decrease
Ishpeming Laboratory Charges	8076.55	10809.23	2732.68
Shipping Department Expense	2076.58	2820.77	744.19
Mine Sampling	1373.31	2658.71	1285.40
Total	11526.44	16288.71	4762.27

Idle expense charged with 1,259.54.

8. COST OF OPERATING: (CONT.)

b. Detailed Cost Comparison: (Cont.)

(7) Detail of Accounts: (Cont.)

32. Personal Injury:

	1946	1945	Decrease
Compensation & Doctors	7523.33	32923.95	25400.62
Compensation Department	584.86	651.02	66.16
Hospital Loss	3847.75	5870.19	2022.44
Mine Charges		3.80	3.80
Total	11955.94	39448.96	27493.02

Idle expense charged with 2,312.82. Decrease due to claims paid in 1945.

35. Local and General Welfare:

	1946	1945	Decrease
General Welfare	1984.46	3191.51	1207.05
Local Welfare	519.41	692.43	173.02
Total	2503.87	3883.94	1380.07

Amount charged to idle expense - 912.00.

36. Special Expense, Pensions and Allowances:

	1946	1945	Increase	Decrease
Pensions	474.90	953.62		478.72
Retirements	2366.79	3053.13		686.34
Legal	1008.21	396.28	611.93	
Examinations	368.50	1799.60		1431.10
Employment Office	573.13	876.26		303.13
Other	480.87	1810.87		1330.00
Total	5272.40	8889.76		3617.36

Amount charged to idle expense - 1,805.80

37. Ishpeming Office:

Expenditures decreased 3,912.51. Amount charged to idle expense - 4,946.00.

38. Social Security Taxes:

	1946	1945	Decrease
Unemployment Insurance Tax	7215.84	9990.38	2774.54
Old Age Benefit Tax	5551.14	7684.86	2133.72
Total	12766.98	17675.24	4908.26

Amount charged to idle expense - 1,828.51.

39. Mine Office:

	1946	1945	Decrease
Mine Office	9722.18	12386.99	2664.81
Superintendence	3553.70	4773.62	1219.92
Central Warehouse	2349.63	3142.81	793.18
Total	15625.51	20303.42	4677.91

Amount charged to idle expense - 5,055.86.

NEGAUNEE MINE
ANNUAL REPORT
YEAR 1946

8. COST OF OPERATING:

a-1. Idle Expense:

The following expense was incurred during the strike of the United Steel Workers Union and is listed as the idle expense. This strike commenced on February 8th and the mine was reopened for production on May 22nd.

Exploring in Mine		137.62
Timbering		6376.19
Tramming		352.14
Ventilation		2464.49
Pumping		10792.59
Compressor and Air Pipes		2635.71
Underground Superintendence		7170.16
Maintenance:	Compressor & Power Drills	14.57
	Scrapers and Loaders	21.86
	Electric Tram Equipment	499.00
	Pumping Machinery	102.90
TOTAL UNDERGROUND COSTS		30567.23
Hoisting		4656.33
Stocking Ore		345.58
Dry House		2765.06
General Surface Expense		3173.01
Maintenance:	Hoisting Equipment	480.78
	Shaft	30.19
	Mine Buildings	31.98
TOTAL SURFACE COSTS		11482.93
Mining Engineering		910.37
Mechanical & Electrical Engineering		553.19
Analysis & Grading		1259.54
Safety Department		511.00
Telephones & Safety Devices		718.38
Local & General Welfare		912.00
Special Expense, Pensions & Allowances		1805.80
Ishpeming Office		4946.00
Mine Office		5055.86
Insurance		1241.99
Personal Injury		2312.82
Social Security Taxes		1828.51
Employees Vacation Pay		7520.00
Group Annuity Premiums		335.92
TOTAL GENERAL MINE EXPENSES		29911.38
COST OF PRODUCTION		71961.54

The idle expense cost sheet as shown above is divided into four parts, viz., Underground Costs & Surface Costs, both of which are at the mine, together with General Mine Expenses and Taxes. With reference to Underground Costs, the greatest expenditure is that of timbering and maintaining the various drifts and raises on and above the 14th Level. During the idle period the supervisory force carried on this general repair work. The addition of this cost to that of timbering amounts to roughly 13,500.00. The remaining figures are more or less fixed charges with respect to ventilation, pumping, hoisting and dry house.

NEGAUNEE MINE
ANNUAL REPORT
YEAR 1946

8. COST OF OPERATING: (CONT.)

a-1. Idle Expense: (Cont.)

Early in March it was decided to change the armature in the large skip hoist motor, which at that time had several coils shorted out with the possibility of more failing at any time. Approximately six days were required to remove the old armature and install the spare which had been reconditioned in 1942.

The relatively high general surface expense was due to the comparatively large receipts of timber delivered by rail requiring immediate unloading. The labor secured for this job was by agreement with the union in the earlier part of the strike period.

The total number of employees, including the office force, underground supervisors, surface men and pumpmen amounted to thirty men. On the 21st of March, at which time the company announced a general increase of ten cents per hour, a maximum of sixty-two men returned to work. This number gradually decreased as pressure was brought to bear by the various outside union members. From that time on the average number of employees remained at thirty men.

In dividing the total cost of maintaining the mine together with overhead expenses, all totaling 71,961.54, by the 1946 production, the actual cost amounted to .173 per ton or approximately 810.00 per idle day.

NEGAUNEE MINE
ANNUAL REPORT
YEAR 1946

9. EXPLORATIONS AND FUTURE EXPLORATIONS:

Early in 1946 there were several prospects in the mine where exploration was deemed advisable. One of these localities was on the 9th Level where the north limb of the Negaunee south footwall contacts the irregular capping. The trough-like basin at this elevation is in a north-south section approximately 1400 feet wide. The west limb of the ore originally rose 300 feet above the 9th Level, while the east limb was apparently eroded away. The actual height above the 9th Level on this side is less than 40 feet, surrounded by soft ore jasper which is enriched in local areas. In the original driving of the 9th Level drift a rather rich jasper pocket was intersected which gave some indication of further concentration to the north and west. It was into this area that diamond drill holes No. 52 and 53 were drilled. As indicated by the table below, the material was entirely jasper and after the completion of Hole No. 53, which was driven nearly due north, further exploration work was abandoned.

Hole No.	Location	Dip	Direction	Material	Started	Stopped
52	9th Level Elev. 604	∠1°	N54°W	0-206 Soft Ore Jasper 206-265 Blue Jasper	6/6/46	6/28/46
53	9th Level	∠3°	N1°E	0-199 Soft Ore Jasper	7/1/46	7/20/46

The second area which appeared to have some merit in further explorations was south and west of the stoping area near the Maas Boundary. In 1945 a small drift was driven to the south on the 115' Sub-level elevation into the footwall slates. Near the south end of this drift a fault zone was intersected and on the completion of the 9th Level drilling it was decided to explore further to the south on the 115' Sub-level. This hole would explore the structural relationship adjacent to the above-mentioned fault zone as well as locate the contact of the jasper band which cuts in this direction from the high-sulphur area near the main No. 3 Shaft. After the hole had advanced 503 feet, or to a point well beyond the expected contact, there was no further need of exploring, with the result that the hole was stopped and diamond drilling abandoned for the year.

54	∠115' Sub	∠5°	S1°E	0-323 Slate 323-503 Soft Ore Jasper	7/24/46	9/11/46

With reference to future explorations, there was none anticipated, inasmuch as all known ore bodies have been explored and developed.

THE NEGAUNEE MINE COMPANY

10. TAXES

COMPARATIVE STATEMENT OF TAXES FOR YEARS 1946 & 1945

DESCRIPTION		1946 VALUATION	1946 TAXES	1945 VALUATION	1945 TAXES
NEGAUNEE MINE:					
Including stockpile, supplies and equipment as placed by Tax Commission					
Real Estate		1,265,000	55,841.27	1,765,000	74,461.64
Personal Property		384,483	16,972.34	498,440	21,028.47
Collection Fee 1%			728.14		954.90
Total Operating Negaunee Mine		1,649,483	73,541.75	2,263,440	96,445.01
Rented Buildings		5,260	232.20	3,710	156.50
Collection Fee 1%			2.32		1.57
Total Operating Rented Buildings	(1)	5,260	234.52	3,710	158.07
Total Negaunee Mine		1,654,743	73,776.27	2,267,150	96,603.08
MATHER MINE:					
Including stockpile, supplies and equipment as placed by Tax Commission					
Real Estate		1,615,000	57,999.50	1,770,000	63,608.84
Personal Property		385,000	13,826.51	230,000	8,265.56
Pipe Line "Cloverdale Tract"		350	12.57	350	12.57
Total		2,000,350	71,838.58	2,000,350	71,886.97
Real Estate -Section 1-47-27 (Jackson)		500,000	22,071.65	500,000	21,093.95
Collection Fee 1%			220.72		210.94
Total Jackson		500,000	22,292.37	500,000	21,304.89
Total Operating Mather Mine		2,500,350	94,130.95	2,500,350	93,191.86
TOTAL NEGAUNEE MINE COMPANY	(2)	4,155,093	167,907.22	4,767,500	189,794.94
(1) Detail of Rented Buildings (Includes 1% Collection Fee)					
Lot 7B-2 (C.C.I.Co.-1st Addition)		1,140	50.82	1,140	48.57
W½ Lot 13 (Penhale) 1944		855	38.12	855	36.43
Jackson Mine Office		665	29.65	665	28.33
Lot 3, Block 7 -(Uren) 1945		930	42.36	100	4.26
Lot 12, Block 6 -(Abbot) 1945		950	42.36	950	40.48
W½ Lot 5, Block 5 -(Toms) 1945		700	31.21		
		5,260	234.52	3,710	158.07
(2) Total Taxes:					
City of Negaunee		2,154,743	96,068.64	2,767,150	117,907.97
City of Ishpeming		2,000,350	71,838.58	2,000,350	71,886.97
Total Taxes as above		4,155,093	167,907.22	4,767,500	189,794.94
Total Taxes paid to cities of Ishpeming and Negaunee			168,599.05		191,565.47
Less: Taxes charged to C.C.I. Co.			691.83		1,770.53
Total Taxes charged to Operations			167,907.22		189,794.94

NEGAUNEE MINE
ANNUAL REPORT
YEAR 1946

11. ACCIDENTS AND PERSONAL INJURY:

The safety record for the Negaunee Mine in 1946 showed a decided improvement over that of the preceding year. The severity rate, which is the recognized basis on which accidents are comparable, was .931 in 1946 and 3.557 in 1945. The low severity figure placed the mine in No. 2 position with respect to the other nine underground properties of the company. This record has only been attained by the efforts of all employees and the supervisory force. It has also been improved by periodic meetings of employees where accident prevention has been the main subject.

The most frequent cause of underground accidents results from falls of ground, and this has been particularly guarded against throughout the year. The record shows that two accidents were attributable to this condition and in keeping this cause down, other causes are also held to a minimum. The following statement lists the various compensable accidents for the past five years and indicates a substantial improvement since 1943:

	1946	1945	1944	1943	1942
Fatal	0	0	0	1	1
Time Lost - Over 4 months	1	4	3	3	5
- 1 to 4 months	2	6	5	15	5
- Less than 1 month	8	7	11	17	16
Total Compensable Accidents	11	17	19	36	27
No. of cases paid compensation for accidents prior to Jan. 1, 1946	8	10	8	8	6
No. of cases being paid difference in wages (Inc. in above total)	1	2	2	1	1

12. NEW CONSTRUCTION AND PROPOSED NEW CONSTRUCTION:

There was no new construction or proposed new construction work in 1946.

13. EQUIPMENT AND PROPOSED EQUIPMENT:

a. General:

As a result of two severe electrical storms the large induction motor which drives the Ingersoll-Rand Compressor was damaged to such an extent that seven coils were cut out, greatly reducing the efficiency and power of the motor. Inasmuch as this compressor is the main source of compressed air underground, it has been impossible to have the motor rewound. In an effort to prevent any further delay, a four-inch air line was laid in the 11th Level drift which connects with the Athens shaft approximately 1100 feet southwest of the main Negaunee shaft. Any further delay resulting in damage to the motor can now be offset by making a quick connection with the Athens Mine, where considerable compressed air capacity exists. In using this line together with the use of the smaller Nordberg compressor in the engine house, sufficient air can be made to adequately supply all mining needs.

13. EQUIPMENT AND PROPOSED EQUIPMENT: (CONT.)

a. General: (Cont.)

With the gradual reduction of mining contracts a considerable amount of surplus equipment has accumula ted. In many instances this equipment can b e used to replace that which has become obsolete or worn out, with the result that purchases can be held to a minimum.

b. Steam Shovels:

The 120-B Bucyrus-Erie electric shovel which was purchased for the Mather Mine but used temporarily at the Negaunee Mine for stockpile shipments, was operated throughout the 1946 season. In December, due to the anticipated increased production at the Mather Mine, the electric shovel was dismantled and moved to the Mather for use during the 1947 season. The No. 7 Bucyrus steam shovel was moved to the Negaunee Mine at the close of the shipping season. This shovel is owned by the Negaunee Mine Company and will be used in loading the remaining ore from the mine.

c. Scraper Hoists:

Following is a list of scraper hoists at the mine:

		1946		1945	
Company	Total Machines	Total Machines Repaired	Cost of Each Mach. Repaired	Total Machines Repaired	Cost of Each Mach. Repaired
I.-R. 10 H.P. Elec.	1	1	44.14	2	279.44
I.-R. 15 H.P. Elec.	8	4	252.20	1	347.79
I.-R. 20 H. P. Elec.	12	-	---	2	535.80
I.-R. 25 H.P. Elec.	2	-	---	-	---
Sul. 15. H.P. Elec.	11	1	408.43	4	267.25
Sul. 20 H.P. Elec.	1	-	---	-	---
Sul. 25 H.P. Elec.	2	-	---	-	---
Total	36	6		9	
Total cost repairs all scraper hoists:			1461.36		3047.27

d. Underground Tram Cars:

Repairs to all underground tram cars were carried on at the mine during 1946.

e. Drill Equipment:

All drilling equipment was serviced at the mine and no new machines were purchased during 1946.

f. Haulage Tracks:

Following is a detailed cost of haulage tracks for 1946 and 1945:

	1946	1945
40# Rail	90.40	135.60
Ties & Tie Plates	195.04	198.01
Total	285.44	333.61

NEGAUNEE MINE
ANNUAL REPORT
YEAR 1946

13. EQUIPMENT AND PROPOSED EQUIPMENT:

g. Timber Hoists:

There were no new timber hoists purchased during 1946.

h. Mine Truck:

The 1-1/2 ton Chevrolet hydraulic dump truck purchased in 1943 was kept in good repair throughout the year.

14. MAINTENANCE AND REPAIRS:

Expenditures for maintenance and repairs in the accounts listed under "Underground Costs" were 30,266.30 in 1946 as compared with 40,127.16 in 1945, a decrease of 9,860.86. The cost per ton was .073 for 1946 as compared with .062 in 1945.

The following is a list of purchases and repair costs for 1946 & 1945:

Purchases:	1946	1945	Increase	Decrease
42,060' Wire Rope for Scrapers	4557.14	6420.77		1863.63
1 JB-4 Drill Machine		205.00		205.00
1 #7 Air Sludge Pump		180.00		180.00
Total Purchases	4557.14	6805.77		2248.63
Repairs to:				
Comp. & Power Drills	705.22	291.33	413.89	
Scraper Hoists & Scrapers	7484.18	11068.87		3584.69
Generators	11.94	918.05		906.11
Locomotives	5690.54	6870.24		1179.70
Wiring	1406.47	1247.39	159.08	
Tracks	5840.36	8309.35		2468.99
Cars	2522.98	3490.15		967.17
Pumping Machinery	2047.47	1126.01	921.46	
Total Repairs	25709.16	33321.39		7612.23
Grand Total	30266.30	40127.16		9860.86

Expenditures for maintenance and repairs in accounts listed under "Surface Costs" amounted to 12,534.33 in 1946 as compared with 15,504.45 in 1945. The cost pe r ton was .030 in 1946 as compared with .024 in 1945. The following is a list of repair costs for 1946 and 1945:

2 New Hoisting Ropes	1371.46	1296.11	75.35	
Sheaves	157.54	312.67		155.13
Repairs to Hoists	1113.06	749.35	363.71	
Repairs to Skips & Cages	1712.17	3561.48		1849.31
Repairs to Shaft	2963.74	3862.00		898.26
Repairs to Top Tram Motors	16.26	246.73		230.47
Repairs to Tracks & Cars	277.16	297.76		20.60
Wire Rope, Sheaves & Rollers	900.80	2036.03		1135.23
Repairs to Permanent Trestles	360.44	1649.53		1289.09
Repairs to Pockets	592.56	546.24	46.32	
Repairs to Mine Buildings	3069.14	946.55	2122.59	
Total	12534.33	15504.45		2970.12

NEGAUNEE MINE
ANNUAL REPORT
YEAR 1946

15. POWER:

Following is a detail of electric current purchased in 1946 and 1945, the distribution of charges to various accounts and other data:

	1946 - 9 Months Optg.		1945 - 12 Months Optg.	
	Cost	Per Ton	Cost	Per Ton
Stoping	2160.00	.0052	2880.00	.0044
Timbering	90.00	.0002	120.00	.0002
Compressors	16615.26	.0399	28134.75	.0430
Ventilation	4387.06	.0105	6054.78	.0093
Pumping	17085.74	.0412	23270.89	.0355
Hoisting	15401.37	.0370	23484.86	.0358
Stocking Ore	128.42	.0003	248.25	.0004
Dry House Expense	912.65	.0022	1160.88	.0018
Tel. & Safety Devices	1035.00	.0025	1380.00	.0021
Mine Office	63.61	.0002	98.87	.0002
Electric Haulage	6450.48	.0155	8909.03	.0136
Shops	537.04	.0013	761.40	.0012
District Carpenter Shop	12.18	----	12.90	----
Surface Lighting	170.36	.0004	257.40	.0004
Total	65049.17	.1564	96774.01	.1479

Main Line Meter - K. W.	4,921,600	7,347,200
Separate Meter Readings - K. W.	4,914,846	7,243,449
Line Loss - K. W.	6,754	103,751
Product - Tons	416,021	654,447
K. W. Per Ton (Inc. Line Loss)	11.83	11.23
Cost Per K. W. (Avg. for Year)	.01419	.01443
15 Min. Demand - K.W.(Avg. for Year)	1519	1619
Load Factor - K. W. (Avg. for Year)	50%	50%

17. CONDITION OF PREMISES:

a. Mine Grounds:

The grounds around the mine were kept in good condition throughout the year. During the winter months all roads and parking lots were kept free from snow.

b. Negaunee Mine Houses:

At present there are six houses owned by the Negaunee Mine Company. The cost of repairs to all houses amounted to 1,226.71, and the revenue from rents was 2,066.70.

NEGAUNEE MINE
ANNUAL REPORT
YEAR 1946

18. NATIONALITY OF EMPLOYEES:

The nationality record of employees is submitted in two forms, one as to parentage, the other as to country of birth:

As to Parentage:	1946	Percent	1945	Percent
Finnish	145	52.5	147	49.5
English	48	17.4	56	18.9
Italian	29	10.5	34	11.4
Swedish	22	8.1	20	6.7
French (Canadian)	18	6.5	19	6.4
Austrian	6	2.2	10	3.4
Norwegian	2	0.7	3	1.0
German	-	---	2	0.7
Danish	1	0.3	1	0.3
Belgian	2	0.7	2	0.7
Irish	1	0.3	1	0.3
Polish	2	0.7	2	0.7
Total	276	100.0	297	100.0

As To Birth:

	American Born		Foreign Born	
	1946	1945	1946	1945
Finnish	92	89	53	58
English	37	45	11	11
Italian	13	17	16	17
Swedish	17	15	5	5
French (Canadian)	17	18	1	1
Austrian	4	8	2	2
Norwegian	2	3		
German	-	2		
Danish	1	1		
Belgian	2	2		
Irish	1	1		
Polish	2	2	---	---
Total	188	203	88	94

WRA/jl - 5
3/20/47

NORTH JACKSON MINE
ANNUAL REPORT
YEAR 1946

1. GENERAL:

There was no work carried on at this idle property in 1946. These open pits have been inactive for the past 38 years.

6. SURFACE:

The fences around the open pits were inspected early in the summer and necessary repairs were made.

a. Buildings:

The following dwellings and property located in Section 1 are managed by the Negaunee Mine Company and in particular by the Negaunee Mine:

Jackson #1 ------ Former Jackson Mine Office
Jackson #2 ------ Penhale Property
Jackson #3 ------ Uren Property
Jackson #4 ------ Abbott Property
Jackson #5 ------ Toms Property

The dwellings listed above were maintained throughout the year and required only a limited amount of small repairs. Jackson House #5, which was vacated early in 1946 required considerable repairs in order to bring it into a livable condition. This house and all those listed above were fully occupied during the year, and the net revenue from rents after repairs amounted to approxima tely $850.00

10. TAXES:

	1946		1945	
	Valuation	Taxes	Valuation	Taxes
47% of realty as described in Sec. 1-47-27	235,000.00	10,373.68	235,000.00	9,914.16
Collect ion Fees		103.74		99.14
Total	235,000.00	10,477.42	235,000.00	10,013.30
RENTED BUILDINGS:				
Old Jackson Office - #1	665.00	29.36	665.00	28.05
Penhale Property - #2	855.00	37.74	855.00	36.07
Uran Property - #3	950.00	41.94	100.00	4.22
Abbott Property - #4	950.00	41.94	950.00	40.08
Toms Property - #5	700.00	30.90		
Total	4,120.00	181.88	2,570.00	108.42
Collection Fees		1.82		1.08
Grand Total	4,120.00	183.70	2,570.00	109.50

Total Negaunee Mine Company 1946:

239,120.00 10,661.12

Taxes incre ased due to the higher tax rate in the City of Negaunee.

WRA/jl - 3
6/19/46

SOUTH JACKSON MINE
ANNUAL REPORT
YEAR 1946

1. GENERAL:

There was no change in conditions at this idle property in 1946.

4. ESTIMATE OF ORE RESERVES:

a. Available Ore:

Above present pit available by present system of mining:

On Southwest Side	35,000	tons
North of Lucy Pit	5,000	"
South & Southwest of Lucy Pit	3,000	"
Total	43,000	"

Below present pit and above drainage tunnel available by milling:

West of Crusher	186,000	Tons
Area below bottom of present pit shown by churn drilling	105,226	"
Total	291,226	"
Grand Total	354,226	"

c. Estimated Analysis:

	Iron	Phos.	Silica	Alum.	Mang.	Lime	Mag.	Sul.	Igni.	Moist.
Natural	34.55	.066	36.00	1.42	2.00	.435	.175	.010	2.00	7.00

6. SURFACE:

The fences around the open pits and shafts were inspected and repaired where necessary.

10. TAXES:

	1946		1945	
	Valuation	Taxes	Valuation	Taxes
53% of realty as described in Sec. 1-47-27	265,000.00	11,697.97	265,000.00	11,179.79
Collection Fees		116.98		111.80
Total	265,000.00	11,814.95	265,000.00	11,291.59

Taxes increased due to the higher tax rate in the City of Negaunee.

WRA/jl - 3
6/19/47

ANNUAL REPORT
GWINN DISTRICT GENERAL
YEAR 1946

1. GENERAL

Princeton Mine

The only active property at the beginning of the year, the Princeton Mine produced 28,438 tons of ore up to the labor strike on February 9, 1946. Continuance of the strike with no provision for maintenance of the property resulted in a complete loss of the underground ore production workings by crushing. The mine was abandoned on July 5, 1946 at which time the pumps were removed.

The property shipped a total of 87,747 tons of Cambridge ore during the 1946 season. The shovel crew was employed between ore loading intervals on dismantling of the stocking trestles, which material was immediately delivered to other Company properties for ore stocking use.

Townsite

The Gwinn Club property was deeded by the Company to the Forsyth Township School system on July 15, 1946. The facilities of the club house were offered to the community by the school system and were continued throughout the year by sale of memberships in the club.

House and Lot Sales

All Company houses, with the exception of three in the Gwinn Townsite, Superintendent's, Doctor's and Captain's, were sold during the year. The remaining five sides of the double houses were sold, also the house previously occupied by the Princeton Mine captain.

Details of Gwinn Townsite transactions are given below:

Street	House No.	Lot	Block	Name of Purchaser	Amount
Ash	216	22	26	Lempi Ruotsala	$ 450.00
Maple	250	34	27	Anton Ekola	508.00
Ash	245	2	30	Albert J. Roman	432.00
Ash	234	27	26	" "	486.00
Ash	257	8	31	" "	464.40
Pine	88	10	12	George D. Gilbert	2750.00

During 1946 the following lots in Gwinn Townsite were sold:

Lot No.	21	of Block No.	25	to	Hilma Asikainen	$ 125.00
" "	5	of " "	27	to	Edward Nordeen	100.00
" "	21	of " "	23	to	Louis Tousignant	100.00
" "	19&20	of " "	7	to	Craell J. Pepin	300.00
" "	20	of " "	24	to	Fred Soyring	100.00
" "	1 &2	of " "	16	to	Erick Marjomaki	112.50
" "	14	of " "	10	to	George M. Sharkey	87.50
" "	15	of " "	10	to	" "	87.50
" "	16	of " "	10	to	" "	100.00
" "	17	of " "	10	to	" "	100.00
" "	18	of " "	10	to	" "	87.50
" "	5	of " "	10	to	Gustave Anderson	112.50
" "	14	of " "	14	to	Melio Arrieri	100.00

All of the above sales were for cash, and amounts remitted to Land Department for execution of deed.

ANNUAL REPORT
GWINN DISTRICT GENERAL
YEAR 1946

1. GENERAL: (Continued)

a. Statement Showing Total Ore Produced in District by C.C.I. Co., 1903 to 1946 Incl.

YEAR	AUSTIN	PRINCETON	STEPHENSON	GWINN	FRANCIS	GARDNER MACKINAW	TOTAL
Total to 1946	1,589,018	2,382,172	3,835,157	988,665	504,667	1,289,118	10,588,797
1946 Product		28,438					28,438
To Date	1,589,018	2,410,610	3,835,157	988,665	504,667	1,289,118	10,617,235

b. Statement Showing Ore Shipments by C.C.I. Co., from 1905 to 1946

YEAR	AUSTIN	PRINCETON	STEPHENSON	GWINN	FRANCIS	GARDNER MACKINAW	TOTAL
Total to 1946	1,589,018	2,193,018	3,845,027	1,017,334*	502,131	1,326,439	10,472,967
1946		87,747					87,747
To Date	1,589,018	2,280,765	3,845,027	1,017,334*	502,131	1,326,439	10,560,714

* Included in the shipments from Gwinn Mine is 29,009 tons of Foundry Stockpile ore purchased from the Clement Quinn Company and shipped by the Cleveland-Cliffs Iron Company in 1942.

c. Ore in Stock at Mines December 31, 1946

Princeton - 129,885 tons Cambridge Grade

10. TAXES

Forsyth Township Mineral Lands, Gwinn			1946 Valuation	1946 Taxes	1945 Valuation	1945 Taxes
SW¼ of SW¼ of Sec. 26-45-25	40	A.	$ 100	$ 2.58	$ 100	$ 2.52
NE¼ of SE¼ of Sec. 28-45-25	40	A.	100	2.58	100	2.52
N½ of NE¼ of Sec. 34-45-25	80	A.	200	5.15	200	5.04
SE of NE¼ of Sec. 34-45-25	40	A.	100	2.58	100	2.52
NE¼ of NW¼ of Sec. 34-45-25	38.05	A.	100	2.58	100	2.52
NE¼ of SE¼ of Sec. 34-45-25	36.3	A.	100	2.58	100	2.52
NW¼ of Section 35-45-25	160	A.	400	10.30	400	10.08
Lots 1, 2 and 3 of Sec.36-45-25	.53	A.	125	3.23	125	3.15
Lots 7, 8 and 9 of Sec.36-45-25	98.92	A	260	6.71	260	6.55
Lots 11 of Sec. 36-45-25	13.3	A.	25	.65	25	.63
Undg. ½ of S½ of NE¼ of Sec.28-45-25	80	A	150	3.86	150	3.78
Total			$1,660	$42.80	$ 1,660	$41.83
Collection Fee				.43		.42
Total Taxes				$43.23		$42.25

ANNUAL REPORT
GWINN DISTRICT GENERAL
YEAR 1946

10. TAXES (Continued)

		1946		1945	
Gwinn Townsite, Surface Only		Valuation	Taxes	Valuation	Taxes
Lot 2, Sec. 21-45-25	43.75 A	$ 100	$ 2.58	$ 100	$ 2.52
NE¼ of SW¼ of Sec. 21-45-25 included in plat	6 A	100	2.58	100	2.52
NE¼ of NW¼ of Sec. 21-45-25	17.54 A	150	3.86	150	3.78
S½ of NW¼ of Sec. 21-45-25 not included in Plat of Gwinn	25.01 A	200	5.15	200	5.04
E½ of SE¼ of Sec. 21-45-25	65.84 A	150	3.86	150	3.78
W½ of SE¼ of Sec. 21-45-25	38.80 A	300	7.72	300	7.56
Gwinn Townsite Plat		15,410	396.91	20,280	511.13
Supts. Res. W½ of SE¼ of Sec. 21	1.2 A	1,800	46.34	1,800	45.35
NW¼ of NE¼ of Sec. 21-45-25 except for five acres		100	2.58	100	2.52
S½ of NE¼ of Sec. 21-45-25	50.88 A	300	7.72	300	7.56
Total		$18,610	$479.30	$23,480	$591.76
Collection Fee			4.80		5.92
Total Taxes			$484.10		$597.68
Gwinn Townsite Group Divided by Accounts					
From Tax Statement		$18,610	$484.10	$23,480	$597.68
Gwinn Club House, Lot 8, Blk. 17		-	-	500	12.60
Hospital, Lot 9, Blk.25		1,000	25.74	1,000	25.19
Rented Buildings		3,550	86.23	6,620	166.84
Gwinn Townsite, Unsold Lots		14,060	372.13	15,360	393.01
Total Group as per Statement		$18,610	$484.10	$23,480	$597.68
Gardner Mackinaw					
N½ of NE¼ of Sec. 35-45-25	87.35 A	$ 500	$ 12.88	$ 500	$ 12.60
Collection Fee			.13		.12
Total Taxes			$ 13.01		$ 12.72
Machinery in Warehouse		$ 900	$ 23.16	$ 900	$ 22.67
Central Water Plant NW¼ of NE¼ of Sec. 28-45-25					
Personal - District Office		500	13.01	500	12.73
District Crusher, N½ of NE¼ of Sec. 27-45-25		1,000	26.00	1,000	25.44
Total		$ 2,400	$ 62.17	$ 2,400	$ 60.84
Austin Location					
Part of Lot 5, SW¼ of NE¼ of Sec. 20-45-25		$ 50	$ 1.29	$ 50	$ 1.26
NW¼ of SE¼ of Sec. 20-45-25		200	5.15	200	5.04
NE¼ of SW¼ of Sec. 20-45-25		260	6.69	260	6.55
Total		$ 510	$ 13.13	$ 510	$ 12.85
Collection Fee			.13		.13
Total Taxes			$ 13.26		$ 12.98

ANNUAL REPORT
GWINN DISTRICT GENERAL
YEAR 1946

10. TAXES (Continued)

	1946 Valuation	1946 Taxes	1945 Valuation	1945 Taxes
Summary				
Machinery in Warehouse	900	23.39	900	22.90
Stephenson Mine				
Princeton Mine	377,450	9,813.36	422,450	10,749.28
Francis Mine				
Gardner Mackinaw Mine	2,500	64.35	2,500	63.61
Austin Location	510	13.26	510	12.98
Mineral Lands	1,660	43.23	1,660	42.25
Gwinn Townsite	18,610	479.30	23,480	497.68
Gardner Mackinaw Location	500	13.01	500	12.72
Central Water Plant				
Personal - District Office	500	13.01	500	12.73
District Crusher	1,000	26.00	1,000	25.44
Total C.C.I. Co.	403,630	10,488.91	453,500	11,539.59
Cliffs Power & Light Co.	148,150	3,851.91	148,150	3,769.71
Total Taxes (Including 1%)	551,780	14,340.82	601,650	15,309.30
Princeton - Personal Property	325,000	8,449.71	340,000	8,651.35
Taxes Levied - Forsyth Township				
Forsyth Township Valuation	1,091,675		1,123,860	
Rate per $100 of Valuation	2.57417		2.51932	
Amount of Tax Roll				
School Sinking Fund Tax		5,458.38		5,619.30
County Tax		6,713.80		6,181.23
County Road		818.76		1,573.40
Township Tax		2,183.35		2,247.72
Township Debt Service		2,700.00		2,700.00
School		6,659.22		6,855.55
School Debt Service		3,568.00		3,136.41
Rejected Tax		84.83		78.32
Total		28,186.34		28,391.93
Amount Paid by C.C.I. Co.		10,488.91		11,539.59
Amount Paid by C.P. & L. CO.		3,851.91		3,769.71
Total		14,340.82		15,309.30
Percent Paid by C.C.I. Co. & C.P. & L. Co.		50.9%		53.9%

ANNUAL REPORT
GWINN DISTRICT GENERAL
YEAR 1946

16. WATER SUPPLY - GWINN DISTRICT

The new 500 G.P.M. Layne-Northwest pump has served efficiently as a water supply unit and, since its installation in May 1945, has materially reduced operating costs of the water supply. A decrease of $1,140.00 was shown for 1945 over 1944, and a further reduction of $1,576.00 in 1946 over 1945.

Following is a comparative cost statement for operating the Pump Station for the years 1946 and 1945:

	1946	1945	Increase	Decrease
General Expense	$ 202.50	$ 293.66		$ 91.16
Maintenance	308.66	444.30		135.64
Operating	477.88	477.28	.60	
Electric Power Kidder Station	2,010.30	3,212.69		1,202.39
" " Booster "	910.78	964.43		53.65
E&A Depreciation	1,237.14	1,331.16		94.02
Total Cost	$5,147.26	$6,723.52		$1,576.26
Total Revenue Credit	5,464.45	5,939.11		
Gain	$ 317.19			
Deficit		$ 784.41		

Hydrants

Fire hydrant rental to Forsyth Township continued as in the past. A total of 40 hydrants were rented at a charge of $35.00 per unit, or a total of $1,400.00. Cost of upkeep of hydrants, including painting and repairs, and hydrant boxes, amounted to $113.98 for the year.

16(a). SEWER SYSTEM

In addition to the water supply system, the Company has maintained the Gwinn Townsite sewer system. During the past eight years the yearly expenditure for this work was as follows:

1939	$ 722.37
1940	710.69
1941	598.10
1942	336.40
1943	581.06
1944	610.10
1945	842.25
1946	2,024.60

Maintenance work on the sewer system is becoming increasingly more costly because of the fact that the roots of the large bordering trees are entering the lines, causing widespread constriction. A number of such willow trees were felled this past fall near the main sewer outfall to remove this choking threat to the mains.

PRINCETON MINE
ANNUAL REPORT
YEAR 1946

1. GENERAL

Production at the property was halted on February 8, 1946 because of a strike called by the C.I.O. Local #2833, bargaining agent for the employees of the Princeton Mine.

Maintenance of main level drifts, cross-cuts and scraper transfer drifts was continued for the early part of the strike until March 21st, when the introduction by the union of a foreign element to the District caused the Princeton crews to abandon the obviously vital underground maintenance work. As a consequence of the refusal on the part of the underground men to maintain the timber support of the underground workings, the openings very shortly crushed beyond any engineering hope of rehabilitation.

The bulk of the ore reserves lay in the No. 3 ore body area of the property where, because of the nature of the soft, heavy ore formation and equally weak arkose footwall, the crushing was most severe. It had been learned by operating experience that failure of a timber support in this area had a chain reaction on neighboring supports and during pre-strike operations, the timbering had been given sharp scrutiny and constant immediate attention. Consequently, when the Princeton men refused to engage in timbering work in these areas, the efforts of the small supervisory crew, five in number, although splendid in a proportionate sense, were pitifully inadequate to the whole task.

This overwhelmingly one-sided aspect of the maintenance soon necessitated the removal of mining equipment from areas in danger of imminent collapse. Dispersal of the small crew from retimbering to occasional equipment salvage further enhanced the lead in crushing over maintenance, and in April the work of the five man crew was devoted to salvaging what was still possible to recover. The bulk of the underground equipment was salvaged and hoisted to surface by July 5, 1946, at which time the small 500 G.P.M. pump, operating in the 7th Level pumphouse No. 2 Shaft, was brought to surface, suspending all underground pumping at the property.

These results of the refusal of the Princeton employees to maintain timber support of the underground workings were bitterly disappointing to the Princeton supervision, because of the fact that numerous expensive improvements had been completed at the property and others underway, all with an eye towards increasing production and efficiency for the balance of the life of the property. With the collapse of the workings and subsequent forced closing of the property, the benefits of the majority of these improvements, although paid for, were unrealized.

Included among these improvements were:

Underground:

1. A vastly improved method of removing skip pit accumulation which incurred a proved one-tenth expenditure as compared with the former method.

PRINCETON MINE
ANNUAL REPORT
YEAR 1946

1. GENERAL (Continued)

2. Completion of an underground repair station with facilities to repair underground equipment, which heretofore had to be slung below the skip through the hoisting shaft for surface repair; at the expense of removal plus interruption to ore hoisting.

3. A new main level drift had been started in the No. 3 area to serve as a future artery of supply and haulage. With permanency the predominant feature, the timber supports, all of heavy selected pieces, were placed on reinforced concrete footings. The costly stage of an enterprise of this type, working away from the haulage-way in current use, had been accomplished and an additional 30' of this improved style of drift completed up to the time of the strike.

Surface:

1. Improvement of the stocking area had been accomplished in late 1945 with the removal of a rock outcrop by blasting and bull-dozer work to provide additional stocking area. A new stocking trestle had been completed in January 1946 into this area which, in conjunction with another in the opposite side of the shaft, would have assured uninterrupted stocking regardless of shovel activity.

2. A coal dock had been erected to eliminate costly hand unloading methods in previous use.

3. Probably the most important and also costly improvement had been the constant attempt to intercept surface drainage water before it entered the caving area. Whenever men and equipment could be spared from production work, the drainage project was pushed and over the period of a year and a half the surface excavation had produced a ditch grading to a 20' depth with a 30' deep sump. At the 20' depth a seam of relatively unconsolidated ferruginous sandstone was encountered in January 1946 which carried a great deal of surface drainage water, indicating favorable probability of pumping operations to accomplish the drainage interception.

4. A heating plant was installed in the shops with insulated piping carried on trestle work to the No. 3 supply shaft to provide steam for ice thawing work in the shaft during cold weather. Icing conditions in the shaft had caused considerable delay in the past and this installation had been designed to combat the shaft hazard.

PRINCETON MINE
ANNUAL REPORT
YEAR 1946

2. PRODUCTION, SHIPMENTS & INVENTORIES

a. Production by Grades

	PRINCETON		SEC. 19 LEASE		TOTAL	
	1946	1945	1946	1945	1946	1945
Cambridge	19,277	245,355	9,161	23,686	28,438	269,041
Total	19,277	245,355	9,161	23,686	28,438	269,041

b. Shipments

	1946	1945	Decrease
Cambridge	87,747	235,009	147,262

c. Stockpile Inventories

	1946	1945
Cambridge Sec. 19	20,282	24,826
Cambridge Sec. 20	109,603	164,368
Total	129,885	189,194

f. Ore Statement

	Sec. 19 Cambridge	Sec. 20 Cambridge	Total
On Hand Jan. 1, 1946	24,826	164,368	189,194
Output for year	9,161	19,277	28,438
Transfers	13,705	13,705	-
Overrun	-	-	-
Total	20,282	197,350	217,632
Shipments	-	87,747	87,747
Balance on Hand Dec. 31, 1946	20,282	109,603	129,885

3. ANALYSIS

a. Stockpile Analysis as of December 31, 1946

Grade	Tons	Iron	Phos.	Sil.	Mang.	Al.	Lime	Mag.	Sul.	Loss	Moist.
Cambridge	129,885	59.55	.772	5.28	.93	1.10	2.61	.71	.012	1.57	14.03

b. Average Analysis - 1946 Shipments

Grade	Tons	Iron	Phos.	Sil.	Mang.	Al.	Lime	Mag.	Sul.	Loss
Cambridge	87,747	59.55	.762	5.30	.93	1.10	2.61	.71	.012	1.57

PRINCETON MINE
ANNUAL REPORT
YEAR 1946

4. ESTIMATE OF ORE RESERVES

d. Estimated Tonnage as Required by State Tax Commission

	Princeport Sec. 20	Cambridge Sec. 20 #2 Shaft	Cambridge Sec. 20 #3 Shaft	Cambridge Sec. 20 Total	Cambridge Sec. 19	Total Tons
Above 5th Level (1921 est.) No. 2 Shaft	27,842	147,944		147,944		175,786
Above 6th Level			42,522	42,522	5,837	48,359
Between 6th & 7th Levels		28,102	370,699	398,801	47,448	446,249
Below 7th Level		7,971	153,562	161,533		161,533
Gross Total Nov. 30, 1945	27,842	184,017	566,783	750,800	53,285	831,927
Less December Production		1,101	11,205	12,306	7,043	19,349
Gross Total Dec. 31, 1945	27,842	182,916	555,578	738,494	46,242	812,578
Less 10% for Mining & Rock	2,784	18,402	56,678	75,080	5,329	83,193
Net Total Dec. 31, 1945	25,058	164,514	498,900	663,414	40,913	729,385
Less 1946 Production to February 8, 1946			19,277	19,277	9,161	28,438
	25,058	164,514	479,623	644,137	31,752	700,947

5. LABOR & WAGES

A detailed comparison of wages and product between the 32 days operated in 1946 and the total year 1945 would obviously provide information of no value, therefore, no comparative statement is included with this report.

19. GENERAL STATUS OF PROPERTY AS OF DECEMBER 31, 1946

Surface:

Concrete seals, properly reinforced by heavy rail sections imbedded in solid footing in the shaft walls were constructed at the mouths of all three shafts. The seal at the collar of No. 1 shaft was covered by soil bull-dozed into place and the protective fence re-wired. Heavy planking was installed at the collar of No. 2 shaft above the concrete seal until the shaft house is dismantled. No. 3 shaft wood headframe is dismantled and a heavy plank covering firmly placed over the permanent concrete seal. At both No. 2 and No. 3 shafts the concrete seal is approximately 12 feet below the collar, and this space will be back-filled at the earliest opportunity.

Because of the need for trestle material at other Company properties, all accessible trestle bents were dismantled at Princeton surface and material trucked where needed.

Similarly all equipment subject to damage by weather was dismantled and either shipped to other properties or properly stored in the Princeton surface buildings.

Hoisting equipment at No. 2 shaft is intact. At the No. 3 engine house, the converter and motor generator sets were put into service at other mines. The 400 H.P. motor from the No. 3 hoist is intended for use with the sinking equipment at Mather Mine "B" Shaft. One of the 50 H.P. motors from the No. 2 top tram set is being used by the Cliffs Power and Light Company. All of the equipment has been properly recorded and accurate bookkeeping made of disposition.

PRINCETON MINE
ANNUAL REPORT
YEAR 1946

19. GENERAL STATUS OF PROPERTY AS OF DECEMBER 31, 1946 (Continued)

Underground:

The bulk of the underground rail, with the exception of worn curve sections, was removed as was likewise all electrical installation, cable and trolley lines. All underground piping was similarly dealt with. Electrical equipment and metal pipe were included among the hard to get supplies during the year and quick disposition of these items were made to other mines.

All pipe columns and cable were removed from Nos. 2 and 3 shafts; cage and skips removed; head sheaves dismantled and ropes taken off and placed on reels.

Underground haulage cars were readily disposed of and most of the electric haulage locomotives have been removed for service elsewhere. All underground small tools and equipment, air hoists, and the bulk of electric scraper hoists were sent out.

In brief, it can be stated that practically nothing of value was left underground, and most of the equipment removed has been put into service at other Company properties.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1946

1. GENERAL

A production of 55,168 tons was obtained from the mining and development in the east deposit. During the first half of the year the development and mining was conducted under E&A CC-138 and on July 1st the mine was placed on an operating basis. The mine was idle for a period of three and one-half months due to the strike and there were several interruptions to operations caused by pumping difficulties. The labor force was increased about 20% as underground operations were expanded and a working schedule of 2-8 hour shifts per day was maintained throughout the year.

Three major development programs have been conducted during the year in addition to the initial mining. Development for stopes has been continued and a second stope was brought into production and development for a third was well underway at the close of the year. A small size ventilation shaft was sunk near the east deposit to a depth of 318' from surface and a drift connection at this depth was being driven to the orebody. Because of the serious water problem in the east deposit an underground drainage project was started late in the previous year with the hope that conditions can be improved by intercepting water at an elevation above the mining areas. Work was conducted on this program throughout the year, driving the development headings and drilling horizontal holes at an elevation above that to which mining will be conducted. About 200 g.p.m. or about one-third of the total volume draining from the orebody has been encountered in the drilling and development and some decrease in the volume entering the stopes has occurred, but not enough to materially improve the mining conditions. Continued draining over a longer period of time and expansion of the program is planned to obtain more beneficial results.

Some additional drilling was done from surface in the $SW\frac{1}{4}$ of Section 24. Two holes were drilled to explore an area to the southwest from the east deposit and some ore was encountered in one of the holes at the 6th Level elevation and below. The extent of this concentration and its relation, if any, with the east deposit remains to be determined by future exploration from either the proposed 6th Level or additional holes from surface. One hole was drilled on the 4th Level to explore the vertical extent of the east deposit and a width of 45' of ore was proven near the 6th Level elevation. The extreme north end of the deposit above the 4th Level is the only portion that has more favorable width and unless similar or more width is found in unexplored extensions, the outlook for proving up sizeable reserves is not very encouraging.

Shipments from the mine were considerably less and total 47,514 tons of Spies grade loaded from the stockpile and pocket and 3,987 tons of Virgil grade that was stockpile overrun. A small tonnage from the east deposit was shipped as Hi-Sulphur grade.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1946

1. GENERAL (Cont.)

The first stope operation was started at the north end of the deposit late in 1945 and the second stope was brought into production about the middle of the year. The development for the stopes has been seriously hindered because of the water encountered in almost every heading and this forced abandonment of work in some headings temporarily. The initial mining was also conducted under difficult conditions and not until late in the year, after the stopes had been developed to larger size, were conditions materially improved. Control of a bulk of the water is accomplished by installing drain lines wherever possible and by establishing grades on the transfer drifts so the water drains in a direction away from the loading chutes but these measures are added costs to mining that must be borne until more beneficial results from the drainage project are realized.

There was no production during the strike that was called on February 7th and terminated on May 22nd. Only the necessary maintenance men reported regularly for work during this period as did the supervisory and office force. There was no picketing done at this property except on one day when several men took up picket duty, but there was no interference at any time with maintenance men reporting for work. Despite the absence of pickets there was no effort on the part of any group of employees, other than the maintenance men, to report for work. Membership in the Union has remained at practically 100% and loyalty to the Union was certainly demonstrated by the miners in this district. There was no need to schedule any timber repairmen for work during the strike because of the complete absence of crushing conditions underground.

In accordance with the supplementary agreement that was the basis for settlement of the strike, a wage increase of 18½¢ per hour was granted and became effective on May 22nd. The increase was made retroactive for the maintenance men that were employed during the strike and it was applied to rates in effect prior to February 8, 1946.

2. PRODUCTION, SHIPMENTS AND INVENTORIES

a. Production by Grades

	1946	1945
Virgil	-	23,995
Virgil Hi-Sulphur	-	5,376
Total Virgil Lease	-	29,371
Spies	54,091	6,868
Spies Hi-Sulphur	1,077	750
Grand Total	55,168	37,007

There was no production from the Virgil Lease because operations were suspended in this property in 1945. A small tonnage of Hi-Sulphur grade was produced from the east deposit during the initial mining and stocked with the small amount of same grade that was produced in the previous year. It is very likely that one grade of ore with a sulphur content within the allowable limits can be produced in the stopes that will be developed above the 4th Level.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1946

2. PRODUCTION, SHIPMENTS AND INVENTORIES (Cont.)

b. Shipments

Grade	Pocket	Stockpile	Total	Total Last Year
Virgil	-	3,987	3,987	52,774
Virgil Hi-Sulphur	-	-	-	29,932
Total Virgil	-	3,987	3,987	82,706
Spies	32,687	12,433	45,120	367
Spies Hi-Sulphur	-	2,394	2,394	-
Total	32,687	18,814	51,501	83,073
Total Last Year	18,649	64,424	83,073	101,818
Difference	14,038	45,610	31,572	18,745

Total shipments were smaller due to the small production and stockpile inventory. Most of the Virgil grade in stockpile was shipped in the previous year and the small shipment in 1946 represents the remainder of the stockpile overrun. The small tonnage of both Spies grades in stockpile was all loaded out by the close of the shipping season and a small overrun was realized. About 63% of the Spies grade shipment was mixed with the Cliffs Group cargoes.

c. Stockpile Inventories

Grade	Tons
Virgil	-
Spies	15,720
Spies Hi-Sulphur	-
Total	15,720

The stockpile inventory at the end of the year was entirely Spies grade. All the Virgil grade in stockpile was shipped early in the season and the Virgil Hi-Sulphur was cleaned out in the previous year.

d. Division of Product by Levels

The production from the east deposit was obtained entirely from the development and mining on the 4th Level and above.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1946

2. PRODUCTION, SHIPMENTS AND INVENTORIES (Cont.)

e. Production by Months

Month	Spies	Spies Hi-Sulphur	Total	Tons Per Man Per Day	Tons Rock
January	1,729	-	1,729	-	620
February	847	-	847	-	48
March	-	-	-	-	-
April	-	-	-	-	-
May	221	-	221	-	284
June	4,691	-	4,691	-	448
July	5,868	101	5,969	3.69	476
August	6,255	695	6,950	3.91	1,204
September	3,720	-	3,720	2.00	2,496
October	5,791	-	5,791	2.80	2,304
November	11,921	-	11,921	5.96	928
December	11,946	-	11,946	5.63	124
Total	53,239	796	54,035	4.56	8,932
Stkpile Overrun	852	281	1,133		
Grand Total	54,091	1,077	55,168		

f. Ore Statement

	Virgil	Virgil Hi-Sulphur	Spies	Spies Hi-Sulphur	Total	Total Last Year
On Hand January 1, 1946	-	-	6,749	1,317	8,066	23,601
Output for Year	-	-	53,239	796	54,035	37,007
Transfers	-	-	-	-	-	-
Overruns	3,987	-	852	281	5,120	30,531
Total	3,987	-	60,840	2,394	67,221	91,139
Shipments	3,987	-	45,120	2,394	51,501	83,073
Balance on Hand	-	-	15,720°	-	15,720°	8,066

°1,064 tons in cars.

Increase in Output	17,028
Decrease in Shipments	31,572
Increase in Ore on Hand	7,654

The operating schedule for the past five years follows:

1942 - 2-8 Hr. Shifts 5 days per week Jan. 1 to Oct. 16.
2-8 Hr. Shifts 5½ days per week Oct. 17 to Dec. 31.

1943 - 2-8 Hr. Shifts 5½ days per week Jan. 1 to Dec. 31.

1944 - 2-8 Hr. Shifts 5½ days per week Jan. 1 to July 1.
2-8 Hr. Shifts mining and 1-8 Hr. Shift hoisting 5 days per week July 1 to December 31.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1946

2. PRODUCTION, SHIPMENTS AND INVENTORIES (Cont.)

Operating Schedule (Cont.)

1945 - 2-8 Hr. Shifts mining and 1-8 Hr. Shift hoisting 5 days per week Jan. 1 to Jan. 27.
2-8 Hr. Shifts mining and 1-8 Hr. Shift hoisting 6 days per week Jan. 27 to Dec. 31.

1946 - 2-8 Hr. Shifts mining and 1-8 Hr. Shift hoisting 6 days per week Jan. 1 to August 8.
2-8 Hr. Shifts mining and hoisting 6 days per week August 8 to Dec. 31.

g. Delays

There were three serious delays that occurred to operations and in each case pumping difficulties were responsible. The large volume of water draining from the orebody carries a large amount of fine gritty solids that makes it very difficult to maintain the pumps in good working order. Excessive vibration developed when the mud laden water was pumped and this caused numerous leaks to break out in the discharge line. Maintenance work on the pumps, and the whole system, increased to such an extent that it finally became nearly impossible to keep up with the repairs. Conditions were improved only after a settling sump was excavated near the orebody so most of the solids were settled out before the water reached the main pumps. A detail description of the delays is listed below:

On January 14, a bad leak developed in the discharge column at the bottom of the shaft. No pumping could be done while the repairs were being made and it became necessary to close the dam on the 4th Level to provide storage capacity for water. The leak could not be satisfactorily stopped until a section of pipe was welded to by-pass the portion that was causing the trouble and after the repairs were completed, steady operation of the pumps for about 40 hours was required to drain the accumulated water behind the dam. Operations in the new deposit were suspended for 3½ days on this account.

On August 21st another delay to operations occurred because of mechanical difficulties with the pump on the 6th Level. Due to an accumulation of mud in all the sumps, the storage capacity for water was reduced so that the dam on the 4th Level had to be closed again for storing the water while repairs were made. After repairs were completed steady operation of the pump for two full days was required to drain the accumulated water so work could be resumed in the new orebody. Four and one-half days of operations were lost on this account.

On September 14th, operations were again suspended due to the serious pumping situation that developed because of the fast rate at which mud was settling in the various sumps at shaft. Mud was accumulating at a faster rate than it could be cleaned out by a crew that was organized for this purpose and it became obvious that satisfactory operations could not be continued under these conditions. To remedy the situation, mining was temporarily suspended and the crews transferred to excavate a settling sump near the orebody so that a bulk of the mud could be settled out before the water reached the main pumps at shaft. The various sumps at shaft were cleaned during this period as was the main haulage drift and ditch from the orebody to the shaft. Work on the development programs

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1946

2. PRODUCTION, SHIPMENTS AND INVENTORIES (Cont.)

g. Delays (Cont.)

was not interrupted because the source of the mud laden water was entirely from the stope operations. Mining was suspended for a period of four weeks while this work was conducted.

The estimated loss in product because of the above delays was approximately 6,000 tons.

3. ANALYSIS

a. Average Mine Analysis on Output

Grade	Tons	Iron	Phos.	Silica	Sulphur
Spies	54,091	57.83	.231	6.07	.082
Spies Hi-Sulphur	1,077	54.25	.298	7.80	.277

The average analysis on the output shows a slightly higher iron and sulphur content compared to the previous year. The analysis of the Hi-Sulphur grade represents a very small tonnage and it is very likely that production of this grade from stopes above the 4th Level will continue to be very small if any. The average analysis in 1946 is determined mostly from stoping ore whereas last year nearly all the production was from ore development.

b. Analysis of Ore in Stock

Grade	Iron	Phos.	Sil.	Mang.	Alum.	Lime	Mag.	Sul.	Loss	Moist.
Spies, Dried	57.42	.243	6.45	.24	2.62	.20	.21	.079	7.47	
Spies, Nat'l.	51.39	.217	5.77	.21	2.34	.18	.19	.071	6.68	10.50

c. Analysis of Shipments

Grade	Iron	Phos.	Sil.	Mang.	Alum.	Lime	Mag.	Sul.	Loss
Virgil	58.19	.371	4.83	.16	1.90	.47	.28	.086	
Spies	58.00	.226	6.00	.24	2.62	.20	.21	.082	7.47
Spies Hi-Sul.	56.12	.268	8.41	.22				.107	

d. High-Sulphur Ore

The small tonnage of this grade was produced in the initial mining in the second stope. The sulphur content in the ore as indicated by the development work varies over a wide range but an average of about .080 is suggested by proper mixing in the stope operations.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1946

4. ESTIMATE OF ORE RESERVES

a. Developed Ore

The following is an estimate of the reserves made as of December 31, 1946 using a factor of 12 cubic feet per ton:

	Spies	Spies East Deposit Johnson Lease	Total
Above 4th Level	682,775	208,750	891,525
Between 4th & 6th Levels	857,917	-	857,917
Below 6th Level	18,667	-	18,667
Total Gross as of November 30, 1946	1,559,359	208,750	1,768,109
Less December, 1946 Production	11,946	-	11,946
Total Gross as of December 31, 1946	1,547,413	208,750	1,756,163
Less 30% for Mining, Rock, and Pillars &	467,808		
Less Unavailable Ore		208,750	676,558
Net Total as of December 31, 1946	1,079,605	-	1,079,605

The increase in the estimated reserves is due to including ore to a lower depth as proven by D. D. H. No. 20 which was drilled to explore the deposit below the 4th Level. This hole proved ore extending a short distance below the 6th Level whereas in previous estimates the lower limit of ore had been assumed at an elevation of 100' above the 6th Level. The reserves in the Johnson Lease are again excluded from the estimate because this ore is considered economically unavailable due to its close proximity to ledge and the water bearing surface material over-lying the ledge. An extensive water drainage program would be required if mining of the ore in the Johnson Lease is attempted and the reserves in this property are not sufficient to warrant the cost of such a project.

The width of the orebody, where it has been determined either by mining or exploration, is confined to very narrow limits, averaging about 45'. This is very disappointing from the standpoint of both reserves and mining and it is evident that considerably more length and vertical height must be found before a substantial tonnage can be outlined. There are indications that the orebody has favorable extent beyond present known limits as proven at one point by D. D. H. No. 20 which disclosed ore extending to the 6th Level and below. Some exploration to determine the length of ore to the south along the strike was started on the 4th Level early in 1947 and a favorable extension in this direction is anticipated.

The tonnage of ore that must be left in place as supporting pillars represents a substantial part of the total reserves. The size and number of pillar intervals will be determined largely by the nature and attitude of the footwall slate but past experience indicates that approximately 30% must be left in place to support the wall rock.

One of the two holes drilled from surface during the year disclosed ore at the 6th Level elevation and below in an area about 2400' to the southeast of the present workings. This ore lies at a much lower elevation than the proven ore in the east deposit but the area in between offers interesting possibilities for exploration from the 6th Level.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1946

4. ESTIMATE OF ORE RESERVES (Cont.)

b. Estimated Analysis of Ore Reserves

Grade	Iron	Phos.	Sil.	Mang.	Alum.	Lime	Mag.	Sul.	Loss	Moist.
Spies, Dried	57.69	.250	6.50	.20	2.17	.25	.38	.080	6.70	
Spies, Nat'l.	51.64	.224	5.82	.18	1.94	.22	.34	.072	6.00	10.50

5. LABOR AND WAGES

a. General

During the prolonged strike, one thing that was very apparent was the employees' allegiance to their union. The majority of the men appeared stubbornly content to remain off work until the dispute had been settled to the Union's satisfaction. There was evidence that not everyone was in sympathy with the stand the Union had taken but evidently this group was not large enough, or aggressive enough to openly express their feelings and take independent action. As previously stated, there was practically no picketing done and no interferring with the regular maintenance men reporting for work. Surprisingly, an extra crew of maintenance men that were called to work on an installation job during the strike were not molested. When operations were resumed no trouble was experienced in maintaining proper job relations and in general, relations with the employees were renewed on a basis as harmonious as can be expected with a strongly organized labor force.

There were no grievances submitted during the year and the few minor complaints that were brought up were settled in the second step of the procedure. During the past two years employee representation on the grievance committee has been made up of men who have been found to be quite reasonable to deal with. These men, no doubt, have been responsible for squelching many unreasonable demands and complaints and thereby assisting in promoting better relations.

There were 98 men on the payroll at the close of the year compared with 82 at the end of 1945, an increase of nearly 20%. The labor turn-over has been large but there has been an adequate supply of labor to maintain the force at the desired strength. There were 13 employees who quit, 10 were laid off, one was retired and one transferred. A total of 42 men were hired, resulting in a net increase of 16 men.

b. Statement of Wages and Product

	1946	1945
PRODUCT	46,737	29,371
NUMBER OF SHIFTS AND HOURS	2-8	2-8
Average No. of Men Working		
Surface	32½	13
Underground	65	18
Total	97½	31

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1946

5. LABOR AND WAGES (Cont.)

b. Statement of Wages and Product (Cont.)

	1946	1945
Average Wages Per Day		
Surface	8.98	8.23
Underground	10.31	9.46
Total	9.65	8.95
Average Per Month of 22 Days		
Surface	197.56	181.06
Underground	226.82	208.12
Total	212.30	196.90
Product Per Man Per Day		
Surface	12.34	9.39
Underground	6.10	6.53
Total	4.56	3.85
Labor Cost Per Ton		
Surface	.610	.8766
Underground	2.540	1.4461
Total	3.150	2.3227
Average Product Breaking and Tramming	31.39	20.60
Average Wage Contract Miners	12.75	9.02
Total Number of Days		
Surface	7028	3128
Underground	14117	4498½
Total	21145	7626½
Amount for Labor		
Surface	28,517.06	25,747.13
Underground	118,680.22	42,472.61
Total	147,197.28	68,219.74

Proportion Surface to Underground Men

1946	1 to 2.01
1945	1 to 1.38
1944	1 to 1.60
1943	1 to 1.78
1942	1 to 2.16

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1946

6. SURFACE

a. Buildings

There was no new building construction but late in the year work was started renovating the interior of the office building. A portion of the warehouse space will be used to make a room for the warehouse clerk and a clothes change room in the Captain's quarters.

Due to the increase in the size of the underground labor force, 21 additional lockers were installed in the dryhouse. These were purchased from the Princeton Mine. The wood tank along the north side of the dryhouse that was used for cooling the compressor cooling system water was torn down. The tank was badly rotted and it was replaced by a small concrete pond that was constructed near the engine house.

b. Stockpiles

The small stockpile of Virgil grade in the area to the northwest of the shaft was all loaded out by shovel operations and the sollar was cleaned by the bull-dozer before the last shipment was made. After cleaning up the ore the permanent trestle approach into this area was completely rebuilt. This portion of the trestle crossed the loading tracks and all the timber members had become badly rotted after many years of service. Concrete footings were laid for the sills of the new trestle which consisted of two bents 15' in width and four standard width bents. A new plank decking was also laid to cover the rebuilt portion of the trestle. All the Spies grade that was stocked in the area directly north of the shaft was cleaned out before the close of the shipping season and the trestle was reerected for stocking during the winter.

7. UNDERGROUND

a. Shaft Sinking

The preliminary work for sinking the small size ventilation shaft under E&A CC-116-A was completed late in 1945 and sinking operations were started in January. The 15" diameter bore hole that was drilled in the previous year to connect with a raise put up from the 4th Level was used to transfer the broken material to the 4th Level. After sinking a short distance a concrete ring was poured to seal off the seepage of surface water and support the fractured ledge formation at the bottom of the steel casing that extends from the collar to ledge. An 8.0' diameter shaft was sunk to a depth of 318' from surface in hard cherty slate and required no timbering. At 22' intervals hitches were cut in the walls and two bearers installed to support the ladder road. To obtain the speediest advance, it was important that good fragmentation be obtained so the broken material would pass freely through the small bore hole. At the start of the work rounds about 2' in depth were drilled and blasted and this was gradually increased and the best advance was obtained when drilling and blasting rounds 3½' in depth. On two occasions when experimenting with deeper rounds, the bore hole blocked and sinking was delayed for a short period until the hole was unblocked. To minimize the possibility of large pieces entering the hole, the churn drill rig was set up over the shaft collar and the stem of the bit was suspended at the collar of the hole at the bottom of the shaft, restricting the size of the opening. As the crews became familiar with the method of sinking the advance per shift increased and during the last two months satisfactory progress was made. The work was conducted on a two shift schedule with three miners on a shift. The small size shaft did not permit the use of more than three drill machines at one time.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1946

7. UNDERGROUND (Cont.)

a. Shaft Sinking (Cont.)

A ladder road was constructed as sinking progressed and a woven wire netting was installed to case the ladder road from the rest of the shaft. A total of 226' of shaft was sunk to reach a depth of 318' from surface. Upon reaching this depth late in July, drifting operations were started from the bottom of the shaft southeast towards the orebody and the crew was transferred to this work. The following table shows the monthly advance:

Month	Shaft Sinking	Rock Drifting
January	51'	
February	11'	
May	10'	
June	62'	7'
July	92'	7'
Total	226'	14'

b. Development

A large part of the underground work was again confined to development. In the first half of the year operations were conducted under various E&As and when the second stope was brought into production the mine was placed on an operating basis. Development was done under three E&As, namely: Stope Development - E&A CC-138; Shaft Sinking and Ventilation Connection to Orebody - E&A CC-116-A; Water Drainage Project - E&A CC-165 and a drifting project for the M. A. Hanna Company into the Johnson Lease property.

Due to the extent of the development it will be described under the various sub level headings:

Stope Development
1270' Sub Level

This is the highest elevation to which development for stopes has reached and it will be the top elevation of mining in the first three stopes. After four additional mill raises were completed to this elevation, a total of 425' of small drift was advanced in ore north and south along the strike to connect the raises. A small amount of drifting was done in an east-west direction from the mill put up directly above No. 410 Raise. This drift connected two mills and disclosed a width of 45' of ore between the footwall slate and jasper hanging. At the close of the year development had been completed at this elevation for No. 3 Stope.

1240' Sub Level

Three mill raises were completed to this elevation in the previous year and a fourth was put up as development for No. 3 Stope. About 60' of small ore drift was advanced north along the strike to connect the mill with an adjacent one and about 25' of drift was advanced due east to connect with the raise put up for the drainage project.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1946

7. UNDERGROUND (Cont.)

b. Development (Cont.)

1210' Sub Level

Upon completing the most southerly mill to this elevation 75' of small ore drift was advanced to the north along the strike to connect with an adjacent mill and about 15' of small drift was advanced to the northeast to connect with the raise for the drainage project. The development at this elevation was mostly for No. 2 Stope but in the coming year drifting will be conducted to the south from the most southerly mill for No. 3 Stope.

1180' Sub Level

Only a small amount of development was done at this elevation. After the most southerly mill reached this elevation about 30' of small drift was advanced in ore to the north to connect with existing development for No. 2 Stope. Similarly as on the sub levels above, a short drift connection about 10' in length was advanced to the drainage project raise.

1150' Sub Level

Twoadditional mill raises were put up to this elevation as part of the development for No. 3 Stope. About 30' of small drift was advanced in ore north and south along the strike from the most southerly mill and work was underway at the close of the year advancing the mill to higher elevations. About 90' of small ore drift was advanced from the traveling road mill for No. 3 Stope north to connect with existing development for No. 2 Stope.

1100' Sub Level

The development for the first two stopes was nearly completed at this elevation in the previous year. A small amount of additional drifting was done for No. 1 Stope and 40' of small drift was advanced in ore along the strike to provide a traveling connection from a mill to the stope.

1075' Sub Level

Only a small amount of development was done at this elevation for the first two stopes. About 30' of small drift was advanced in ore to connect a mill with the No. 1 Stope near the north end of the orebody. A drift connection 60' in length was advanced north from the mill directly above No. 410 Raise as development for No. 2 Stope.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1946

7. UNDERGROUND (Cont.)

b. Development (Cont.)

1050' Sub Level

In the transfer drift for No. 1 Stope two additional mill raises were put up from the west side. Each of the mills was advanced 25' in ore to extend them to the first sub above the transfer for drawing ore as the stope was enlarged. Near the north end of the transfer for No. 1 Stope, 25' of small ore drift was advanced to the northwest to connect with a mill from the 4th Level for drainage purposes. Considerable difficulty was experienced at first in handling the broken ore on the transfer elevation due to the large amount of water until a grade was established in the drift so that the water drained away from the loading chute. The bulk of it is now draining to the back end of the transfer and this has considerably improved conditions for loading the motor trains.

In the transfer drift for No. 2 Stope four mill raises were put up, three along the west side and one on the east side. Each of the mills was advanced 25' in ore to extend them to the first sub above the transfer. The mills were put up as needed for drawing ore from No. 2 Stope as it was enlarged. A short drift connection was advanced in ore to the northwest from No. 410 Raise to connect with the drainage project raise.

Late in the year work was underway stripping the transfer drift for No. 3 Stope to larger size. The drift was originally driven small size and it was being readied for the start of operations in No. 3 Stope.

4th Level

Only a small amount of main level development was done for the operations in the east deposit. Two short raises were put up for water drainage purposes, one from the northeast crosscut and the other from the main level drift directly east of No. 410 Raise. Each of the raises was put up 25' in ore to connect with the transfer drifts. The raise in the northeast crosscut is serving for draining water from the back end of the transfer for No. 2 Stope and the other is used for draining water from development headings.

In December work was started driving a crosscut on the west side of the orebody to the south from the main haulage drift. About 600' of drifting will be done, most of which will be in rock, to explore the south extension of the orebody. Development on subs above the 4th Level for No. 3 Stope is the furthest exploration conducted south along the strike and there are favorable indications that a continuation of the orebody will be found in this direction so that one and possibly two additional stopes can be developed. D. D. H. No. 3 from surface encountered ore in this area at a depth of 100 to 210' below the 4th Level and a continuation of this ore to the 4th Level and above is anticipated.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1946

7. UNDERGROUND (Cont.)

b. Development (Cont.)

4th Level (Cont.)

A part of the short crosscut that was driven to the southeast on the west side of the orebody in the previous year was utilized for a settling sump that was excavated in the floor. When serious pumping difficulties developed because of the solids carried by the water draining from the east deposit, a sump about 60' in length was excavated to a depth of 8' in the floor of the crosscut. A rock drift connection 70' in length was driven from the end of the sump northeast to connect with the haulage drift so that the water could be diverted into the sump and most of the solids settled out before it reached the main pumps at shaft. The following table shows the footage for stope development:

	Drifting		Raising		
	Ore	Rock	Ore	Rock	Total
Small Size	1,138'	143'	218'	127'	1,626'
Large Size	-	85'	-	22'	107'
Total	1,138'	228'	218'	149'	1,733'

Drainage Project - E&A CC-165
1330' Sub Level

Work was conducted on this project during the entire year. The initial development consisted of putting up a raise in ore to a height of 307' vertically above the level on the footwall side of the orebody. At an elevation of 55' above the top mining sub level, a drift was advanced to the northeast following the strike and a drill station was cut out at the end of the drift. Some drifting was also done across the formation directly over No. 2 Stope to test the hanging wall side for water courses. A number of horizontal holes were then drilled radiating nearly 360° from the station and covering an area roughly 300' in diameter. The first holes were drilled over the stopes but after one test hole to the east into the Bates property disclosed a substantial amount of water on the footwall side, subsequent drilling was confined to this direction. The holes ranged in depth from 40' to 275' and water in varying amount from a maximum of 73 g.p.m. to a minimum of 5 g.p.m. was encountered. The flow gradually diminished from the holes drilled to the hanging wall side and after several months, eight of these were practically dry. A total volume of 200 g.p.m. was draining from the development openings and drill holes at the close of the year. Some decrease in the water entering No. 1 Stope occurred but not enough to materially improve the mining conditions. However, one compensating factor is that there was no increase in water while the stopes were enlarged and if this had occurred it is questionable whether mining could have been conducted. The drilling program was being continued in 1947 in an area farther south with the plan to relieve the water condition in the No. 3 Stope which was still in the development stage. The project will be expanded by drifting south along the strike and also to the east towards the footwall and the drilling will be abandoned later in favor of opening up the footwall side of the Johnson property by drifting. It is more likely that a larger volume can be caught by this means and an improvement in mining conditions realized sooner.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1946

7. UNDERGROUND (Cont.)

b. Development (Cont.)

Drainage Project E&A CC-165 (Cont.)

The following table shows a classification of the development footage on the drainage project:

	Drifting		Raising		
	Ore	Rock	Ore	Rock	Total
Small Size	420'	84'	293'	128'	925'

The following is a log of the drill holes:

D. D. H. No. 21

0'	-	144'	Jas. I. Form.

D. D. H. No. 22

0'	-	99'	Jas. I. Form
99'	-	117'	Slate
117'	-	166'	Slate & Jasper

D. D. H. No. 23

0'	-	119'	Jasper
119'	-	135'	Cherty Slate
135'	-	158'	Slate & Jasper

D. D. H. No. 24

0'	-	75'	Jasper
75'	-	160'	Cherty I. Form.

D. D. H. No. 25

0'	-	157'	Jasper

D. D. H. No. 26

0'	-	97'	Jasper
97'	-	118'	Cherty I. Form.
118'	-	124'	Cherty Slate

D. D. H. No. 27

0'	-	105'	Cherty Ir. Form

D. D. H. No. 28

0'	-	27'	Ore
27'	-	143'	Cherty I. Form

D. D. H. No. 29

0'	-	42'	Ore

D. D. H. No. 30

0'	-	10'	Ore
10'	-	90'	Cherty I. Form.
90'	-	95'	Ore
95'	-	130'	Cherty I. Form.
130'	-	135'	Lean Ore
135'	-	142'	Cherty I. Form.
142'	-	166'	Lean Ore

D. D. H. No. 31

0'	-	35'	Cherty I. Form
35'	-	75'	Slate

D. D. H. No. 32

0'	-	11'	Ore
11'	-	86'	Cherty I. Form.
86'	-	108'	Ore
108'	-	138'	Cherty I. Form.
138'	-	155'	Ore

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1946

7. UNDERGROUND (Cont.)

b. Development (Cont.)

Drainage Project - E&A CC-165 (Cont.)

D. D. H. No. 33			D. D. H. No. 34		
0'	- 35'	2nd Class Ore	0'	- 20'	2nd Class Ore
35'	- 182'	Cherty I. Form	20'	- 274'	Ore

D. D. H. No. 35			D. D. H. No. 36		
0'	- 111'	Cherty I. Form	0'	- 25'	Slate
			25'	- 123'	Ore

Ventilation Connection From Air Shaft to East Deposit - E&A CC-116-A

1330' Sub Level

When the shaft was completed to this elevation work was started driving a rock drift connection southeast to the orebody. A total of 488' of rock drift was advanced to complete the drifting program from the shaft. As in the shaft sinking, the broken material was transferred through the small bore hole to the 4th Level where it was trammed and hoisted to surface. In December the crew was transferred to drive the remainder of the drift west from the orebody. This drifting was conducted from the raise that was put up for the drainage project and at the close of the year about 80' remained to be driven to complete the connection. In addition to serving as a main airway the drift will also be used to divert all the water from the drainage project to pumps that will be installed at the bottom of the air shaft. A concrete dam was constructed in the drift near the shaft and some of the preliminary work such as the pump foundations and the discharge pipe and power line were installed in readiness to handle water when the drift connection was holed.

The following is the development footage on this project:

E&A CC-116-A	
Rock Drifting	488'

Johnson Lease Drift
4th Level

In the latter half of the year the main level drift was extended east into the Johnson property in footwall slate. Three drill stations were cut out along the north side, one about midway in the extension and two near the east end. Short raises in rock were also put up from two of the cut outs to provide head room for drilling angle holes. This development was completed late in the year and the M. A. Hanna Company had two drills in operation exploring an area to the north in the Johnson and Bates Mine properties. The cost of this development was charged to the M. A. Hanna Company. The following table shows the development footage:

Rock Drift	501'
Rock Raise	50'