

LLOYD MINE
ANNUAL REPORT
YEAR 1946

7. UNDERGROUND (Cont.)

c. Stoping (Cont.)

In the east half of the main orebody, two small areas above the 7th Level were mined by top slicing during the first half of the year and then caving and stoping methods were substituted to nearly complete the mining in this area to the 7th Level elevation. In the west half of the main orebody mining has been confined to areas between the 7th and 8th Levels throughout the year. A top slicing method of mining has been continued in two areas during most of the year but these were later converted to a sub caving system. In another area in this part of the orebody where mining has reached the lowest elevation, top slicing is being continued because there is not sufficient vertical height of ore remaining to employ a caving or stoping method. There were three scam stope operations developed in the west half above the 8th Level to recover small pillars of standard grade ore and also some Silica grade after the stopes caved. The life of these stopes was very short and mining was completed in each of them after one to two months of operations.

Two relatively large stope operations were conducted during most of the year in the orebody south of the dike and operations were completed in each of them before the end of the year. Only a narrow width of standard grade ore was disclosed by the development and mining and the height of ore varied from a maximum of 115' above the 8th Level at the east end of the deposit to about 40' above the level at the west end. A large amount of Silica grade was also obtained from both stopes whenever mining was being conducted on the top sub levels adjacent to the jasper hanging. A small westerly extension of the deposit was developed for mining but mostly Silica grade ore will be obtained from this stope because the standard grade ore is confined to a very narrow seam lying along the slate footwall.

At the end of the year mining was being conducted at elevations ranging from the 7th Level at the east end of the main orebody down to the 225' sub level in the west half of the orebody; the latter elevation being the lowest to which mining has reached. Mining contracts have been employed on a three shift schedule throughout the year excepting in several stope operations when a high rate of production was being obtained. At the beginning of the year an average of 14 contracts were employed on mining and development and this was reduced to a total of 11 contracts by the end of the year due to depletion of ore areas. A further reduction in the number of contracts was made early in 1947 due to additional areas being worked out.

Many of the stopes were developed in ore that was soft and caved readily so that benching along one face of the stope could not be done safely. In cases of this kind long blast holes were drilled using coupled sectional steel and vertical rings of radial holes were drilled from the intermediate sub levels. Holes up to 30' in depth were drilled in some cases and the ring of holes was usually blasted simultaneously. Good results were obtained and an important factor is that ore not entirely adaptable to a stoping method was mined safely in this manner.

Mining operations and development work was conducted on a total of 14 different sub levels, three of which were above the 7th Level and 11 above the 8th Level. The following is a detailed description of the mining operations on the various sub levels:

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7. UNDERGROUND (Cont.)

c. Stoping (Cont.)

Subs Above the 7th Level - Main Deposit
390' Sub Level

Three contracts were employed at this elevation early in the year, two of which conducted mining operations from No. 712 Raise and one from No. 710 Raise. An area about 170' x 70' was mined by top slicing between old workings to the west and an old stope at the east end of the orebody.

375' Sub Level

Two contracts mined an area 170' x 60' near the east end of the orebody by stoping. Two scram stopes were developed above transfer drifts on the 7th Level elevation and the mining in both stopes extended to this elevation.

360' Sub Level

Two contracts done some mining at this elevation early in the year from No. 817 and No. 815 Raises. An area 200' x 70' was mined extending from old workings on the west side to a mining limit to the east. Two separate areas were mined by stoping directly east of the latter area and at the close of the year a narrow pillar dividing the stopes remained to be recovered. Similarly as on the sub level above the stoping was conducted above two transfer drifts that were driven on the 7th Level elevation.

7th Level

In the east half of the deposit four contracts conducted mining at this elevation during the year and three of these were still mining at this elevation at the close of the year. In the most easterly portion of the deposit two contracts were engaged in stoping above transfer drifts that were driven to the east and west of No. 821 Raise. Upon completing the stope operation slice drifts were advanced on each side of the transfers to recover the ore pillars lying along the north and south footwall sides. Late in December a drift was being advanced along the south footwall dike to the east to recover a small remaining pillar. To the west of the area that was stoped, three contracts mined an area 200' x 60' by sub caving. Two of the contracts were employed at No. 817 Raise and one at No. 815 Raise. In each case radial drifts were advanced to the ore limits and the pillar above was recovered by caving. Late in December two contracts were employed at No. 817 Raise recovering the remaining pillars and upon completing operations here the contracts will be disbanded due to a lack of other mining areas.

Subs Above the 8th Level
325' Sub Level

One contract mined an area 110' x 70' by slicing in the central part of the deposit from No. 811 Raise. The mining extended from the jasper hanging and an old stope along the west side to a mining limit to the east.

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7. UNDERGROUND (Cont.)

c. Stoping (Cont.)

Subs Above the 8th Level (Cont.)

315' Sub Level

One contract was slicing at this elevation at the close of the year in the central part of the deposit from No. 815 Raise. The same area as described in the preceding paragraph was being mined and operations were nearly completed at this elevation at the end of the year. Two small pillars lying along the north footwall side remain to be recovered after which the contract will move down and develop this area for sub caving.

Early in the year stoping was completed at this elevation near the east end of the orebody south of the dike. This was the top elevation of mining in this orebody and only a small area of ore was disclosed and mined in the crotch formed by the converging slate footwall and diabase dike.

300' Sub Level

Near the west end of the main orebody two contracts completed operations at this elevation early in the year from No. 802 Raise. The major portion of the area was mined in the previous year and a triangular shaped pillar that extended from the raise north to the slate footwall was recovered early in 1946 and both contracts moved down to develop the next lower sub level.

285' Sub Level

Two contracts were employed at this elevation in the area at the west end of the main orebody for a short period and then one of the contracts was transferred to another area. Mining was still being conducted in December from No. 802 Raise by one contract that was recovering a small pillar directly south of the raise. Due to the continual decrease in the size of this ore area as mining has progressed in depth, only one contract can be efficiently employed on subsequent subs. This area will be converted to a sub caving method and preparations were being made at the close of the year to develop a 25' vertical interval for mining.

Development was completed in the east half of the main orebody so the first stope operation could be started between the 7th and 8th Levels late in December. This is the highest elevation to which the stope development was carried and three mill raises that were put up to this elevation were connected by means of a small drift extending for a distance of 300' along the strike. Mining was started in the most easterly stope and an area about 20' in diameter was mined about the most easterly mill raise.

In the orebody south of the dike an area 270' x 30' was mined by stoping at this elevation. This area was mined by two separate stopes which were joined as they were enlarged. A substantial amount of Silica grade was produced in each of the stopes when operations were being conducted at this elevation directly under the jasper hanging.

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7. UNDERGROUND (Cont.)

c. Stoping (Cont.)

Subs Above the 8th Level (Cont.)

275' Sub Level

An area 260' x 30' was mined in the orebody south of the dike by the two stopes. The mining extended from the crotch at the east end formed by the converging slate footwall and dike west to the jasper hanging.

A small scam stope was developed in the main orebody west of No. 809 Raise above a transfer that was driven on the 235' sub level directly below. An area 40' x 15' was mined, most of which was Silica grade.

260' Sub Level

In the orebody south of the dike an area 270' x 30' was mined by the two contracts that were employed in the two separate stopes. Four contracts done some mining at this elevation in the main orebody, one of which started the stope operation at the east end of the orebody and mined an area about 20' in diameter about the most easterly mill. A substantial amount of stope development was also done on this sub level and it consisted of driving a small size drift in ore to connect the series of mills that were put up for the stope development. In the west half of the orebody an area 35' x 15' was mined by a scam stope east of No. 809 Raise and two contracts completed mining an area 150' x 80' from No. 807 and No. 805 Raises.

250' Sub Level

Near the west end of the deposit an area 200' x 70' was mined by slicing operations that were conducted from No. 805 and No. 807 Raises by two contracts. Upon completing operations at this elevation this area was converted to sub caving and a 25' vertical interval was developed for mining.

Two separate small areas were also mined in the west half of the main deposit at this elevation by scam stope operations. Directly east of the slicing area, stoping from a sub level below extended to this elevation and an area 40' x 20' was mined. To the west of the latter area a scam stope operation on a sub level below extended to this elevation and an area 80' x 50' was mined.

In the orebody south of the dike mining from the sub level below extended to this elevation and an area 370' x 30' was mined by the two stope operations.

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7. UNDERGROUND (Cont.)

c. Stoping (Cont.)

Subs Above the 8th Level (Cont.)
235' Sub Level

Three contracts did some mining and development at this elevation during the year in the main orebody. At the east end of the deposit some additional development was done for the most easterly stope in December before mining was started. Two mills along the south footwall side were connected by means of a short drift in ore. In the west half of the orebody one contract was conducting a scam stope operation along the north footwall side. The stope was enlarged in December to 60' x 40' by retreating east toward the traveling raise. Earlier in the year the same contract advanced slice drifts along the north and south sides of the old transfer east of No. 809 Raise and several mills were put up from these drifts to mine a pillar directly above by a scam stope. Near the west end of the orebody two separate small areas were mined by sub caving operations that are being conducted from No. 805 and No. 807 Raises directly below.

In the orebody south of the dike an area 380' in length and varying in width from a maximum of 70' to a minimum of 15' was mined by the two stopes. The most favorable width of ore was found in the west stope but the orebody narrowed rapidly to the east and pinched out at the crotch formed by the converging footwall slate and dike.

225' Sub Level

Development for stopes comprised the major portion of the work done on this elevation as mentioned earlier. Two separate transfer drifts were driven in the east half of the main orebody and a number of mill raises were put up to develop a block of ore between the 7th and 8th Levels for sub level stoping. Near the central part of the deposit a transfer drift was driven to the east of No. 808 Raise and mill raises put up to develop a scam stope. When stope operations were completed a slice drift was advanced along the south side of the transfer in December to recover a small pillar and at the close of the year work was underway driving a drift along the north side of the transfer adjacent to the footwall. Near the west end of the deposit two contracts were carrying on mining operations in December from No. 805 and No. 807 Raises. In each case drifts were being driven to the south to the limits of the ore and the pillar above was recovered by caving.

Two contracts were conducting scam stope operations in the orebody south of the dike in December. Near the east end a scam stope was developed to recover a small pillar of ore lying between the original stope and the dike and operations were completed here before the close of the year. At the west end of the orebody a stope was developed to mine a narrow extension of the orebody and stope operations were still underway in December. An area 90' x 30' was mined retreating to the east. Only a narrow seam of standard grade ore was found in the west extension of the deposit so most of the product from the stope is Silica grade. Due to depletion of ore, operations will be completed in the deposit south of the dike early in 1947.

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7. UNDERGROUND (Cont.)

c. Stoping (Cont.)

Subs Above the 8th Level (Cont.)

225' Sub Level (Cont.)

This is the lowest elevation at which mining was conducted in the two original stopes that were developed in the orebody south of the dike. An area 360' in length and varying in width from a maximum of 60' to a minimum of 15' was mined by the two stopes and operations were completed in each of them during the third quarter of the year.

210' Sub Level

Development for stopes in the orebody south of the dike comprised nearly all the work that was done at this elevation during the year. A small amount of mining was also done near the end of the transfer that was driven to the northwest to explore and develop the west extension of the orebody. As mining in the stope retreats east, the ore lying along the north and south sides of the transfer drift is being recovered.

d. Timbering

There was a large decrease in the amount of timber used compared with the previous year and the amount of poles and lagging consumed was also considerably less. The three and one-half months that the mine was idle because of the strike accounts for most of the decrease but other factors such as the continual reduction in the size of the underground operation and because stoping and caving methods were employed to a larger extent also had effect on reducing the amount of timber used. The cost per ton for these supplies decreased but not in proportion to the smaller consumption because substantial increases were made in the price of all timber supplies during the year.

A smaller timber repair program has been conducted and this work has been confined almost entirely to portions of the 8th Level drift and raises above this level. Hardwood poles and hardwood cribbing have continued to be used in relatively small amounts for specific purposes in place of tamarack. The poles serve very satisfactorily for spiling in the mining areas and because of their greater strength are better than tamarack for this purpose. Hardwood cribbing has been used in raise repairs where resistance to abrasion from handling broken ore is of major importance. In main level rock drifts where support is required, steel sets are being used to a larger extent in preference to timber. Steel rail and "H" beams are used for this purpose and a large portion of the 4th Level drift that serves as an airway and portions of rock drifts on other levels have been lined with the steel sets.

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7. UNDERGROUND (Cont.)

d. Timbering (Cont.)

The following is a comparative timber statement for the past two years:

	<u>Lineal Feet</u>	<u>Avg. Price Per Foot</u>	<u>Amount 1946</u>	<u>Amount 1945</u>
6" to 8" Cribbing Tbr.	10,746	.0626	672.45	2051.91
8" to 10" Stull Tbr.	16,702	.0975	1628.45	4066.66
10" to 12" " "	34,475	.1407	4850.67	5605.15
12" to 14" " "	21,386	.1925	4116.74	3019.69
Total Timber 1946	83,309	.1352	11268.31	
Total Timber 1945	149,430	.0986		14743.41
	<u>Per 100 Feet</u>			
7' Lagging	502,123	1.51	7582.06	12500.93
9½' Poles	205,274	2.30	4721.31	10309.51
Total Poles & Lagging	707,397	1.739	12303.37	22810.44
Product - Tons			247,853	326,633
Feet of Timber per Ton of Ore			.336	.457
Feet of Lagging per Ton of Ore			2.026	2.517
Feet of Lagging per Foot of Timber			6.027	5.502
Cost per Ton for Timber			.0455	.0451
Cost per Ton for Lagging			.0306	.0383
Cost per Ton for Poles			.0190	.0316
Cost per Ton for all Timber			.0951	.1150
Equivalent Stull Timber to Board Measure			251,004	295,967
Feet of Board Measure per ton of Ore			1.0127	.906

The following table shows a comparison of total cost of timbering for the past five years:

<u>Year</u>	<u>Amount</u>	<u>Cost per Ton</u>
1946	23,571.68	.0951
1945	37,553.85	.1150
1944	44,893.17	.1192
1943	44,830.23	.0907
1942	33,627.95	.0592

e. Drifting and Raising

There was a large decrease in the development footage of all classifications as compared with the previous year due to the smaller development program. The major part of the total footage is for sub level stopes the same as in other years.

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7. UNDERGROUND (Cont.)

e. Drifting and Raising (Cont.)

Year	<u>Drifting</u>			Ore	<u>Raising</u>		Grand <u>Total</u>
	<u>Ore</u>	<u>Rock</u>	<u>Total</u>		<u>Rock</u>	<u>Total</u>	
1946	3598'	98'	3696'	1518'	42'	1560'	5256'
1945	3844'	375'	4219'	2147'	127'	2274'	6493'

The following table shows a comparison of the development footage excluding the small drift and raise development for sub level stopes:

Year	<u>Drifting</u>			Ore	<u>Raising</u>		Grand <u>Total</u>
	<u>Ore</u>	<u>Rock</u>	<u>Total</u>		<u>Rock</u>	<u>Total</u>	
1946	1181'	32'	1213'	12'	22'	34'	1247'
1945	740'	340'	1080'	379'	13'	392'	1472'

Early in the year some additional rock development was done on the 8th Level for the proposed 9th Level. This program was abandoned and no work was done on it after the strike was settled. The following table shows the footage of the rock development that was advanced under E&A CC-159:

8th Level	<u>Rock Drift</u>	<u>Total</u>
	100'	100'

f. Explosives, Drilling and Blasting

There was a reduction in the cost per ton for explosives compared with the previous year despite the substantial increase in the price of powder, fuse and blasting caps. The smaller cost is due to a larger proportion of the product being mined by caving and stoping methods in contrast to top slicing methods in the previous year. Another factor that accounts for the lower cost is the change that was made from Gelamite No. 1 to Hercomite powder. The cost of the latter powder is slightly less than the Gelamite and the fact that there are more sticks per case and the breaking strength is practically the same, a change to the Hercomite has resulted in a material saving in cost. When Hercomite was first introduced some difficulty was experienced in charging deep blast holes in the stopes but this was overcome as the miners became more familiar with the characteristics of the powder and very satisfactory results have since been obtained.

A small quantity of Gelatin 60% powder was used in the rock development for the proposed 9th Level early in the year but when this program was abandoned no further use of this powder was made. A small quantity of Herculite No. 4 powder was used for blasting the frozen stockpile before the start of the shipping season similarly as in previous years. In all the raise work master fuse lighters have continued to be used with good results in preference to blasting electrically.

In the larger stope operations where the radial system of drilling long blast holes was employed, Primacord was used with the conventional blasting cap to detonate the powder. Good results have been obtained and there is more assurance in blasting with Primacord that all the powder in the long holes is detonated than with the conventional fuse.

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7. UNDERGROUND (Cont.)

f. Explosives, Drilling and Blasting (Cont.)

The explosive statement is shown in the following table:

<u>BREAKING ORE</u>	<u>Quantity</u> <u>Lbs.</u>	<u>Average</u> <u>Price</u>	<u>Amount</u> <u>1946</u>	<u>Amount</u> <u>1945</u>
Gelamite Powder No. 1	28,104	11.66 C	3,276.23	16,234.59
60% Gelatin	4,745	11.10 C	526.68	-
Herculite No. 4	100	10.00 C	10.00	55.00
Hercomite	69,286	11.66 C	8,085.12	-
Total Powder	102,235	11.10	11,898.03	16,289.59
Fuse - Feet	266,421	5.35 M	1,425.72	2,796.44
No. 6 Blasting Caps	37,030	12.62 M	467.37	945.25
Primacord	3,000	32.00 M	96.00	64.00
Tamping Bags	2,000	2.15 M	4.30	16.45
Fuse Lighters	9,400	6.70 M	62.95	88.20
Fuse Cartridges	1,300	1.99 C	25.85	30.02
No. 20 Connecting Wire				1.10
Electric Blasting Caps				2.74
Total Fuse Caps, etc.			2,082.19	3,944.20
Total Expense Breaking Ore			13,980.22	20,233.79
Product - Tons			247,853	326,633
Lbs. of Powder Per Ton of Ore			.412	.449
Cost Per Ton for Powder			.048	.050
Cost Per Ton for Fuse, Caps, etc.			.0084	.012
Cost Per Ton for All Explosives			.056	.062

Exclusive of the development for the 9th Level which was abandoned, there was very little rock development done during 1946 and consequently no table showing the classification and amounts of powder used in this work is shown.

g. Ventilation

Ventilation conditions in the mine have been quite satisfactory throughout the year. The main fan on the 4th Level at Section 6 shaft has been in continuous operation exhausting the air up this shaft during the summer months and during the freezing weather the fan is reversed to exhaust up the Lloyd shaft. This procedure has been followed for many years and it has prevented ice formation in the hoisting shaft during the winter months.

A decrease has occurred in the total volume delivered by the fan due to the extension of the mine workings, with a resultant increase in the resistance against which the fan is operating. At the close of the year a total volume of 15,600 c.f.m. was measured indicating a drop of nearly 10,000 c.f.m. compared to the surveys made at the close of the previous year. This decrease in volume has not materially affected the ventilation in the mine because there has been nearly a proportionate decrease in the number of mining areas. Several areas that are isolated from the main airways have been ventilated by means of booster fans and this method of ventilation has been necessary throughout the year in the stopes south of the dike. At the west end of the main orebody one area has been ventilated throughout the year in this manner also.

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7. UNDERGROUND (Cont.)

g. Ventilation (Cont.)

On each of the old upper levels that are worked out, but portions of which still serve as ventilation connections, brattices have been constructed to seal off the old workings to prevent a loss of air at these points. Repairs were also made to the doors that seal these levels from the hoisting shaft reducing the volume of air that leaked and short circuited the mine workings. The ventilation raises between the 7th Level and the 4th Level have been cleared of restrictions wherever possible to reduce the resistance to the flow of air.

There were no additional rock ventilation connections driven during the year other than short drifts and raises from mining sub levels to nearby airways. Between the 7th and 8th Levels two raises in the footwall slate, one at the west end and the other near the east end of the orebody, still serve as main airways. The latter raise will soon be lost for ventilation purposes because it will be involved in caving caused by mining operations. The raise at the west end is located a sufficient distance in the footwall so that it will not be affected by mining operations and it will continue to serve as a main airway during the remaining life of the mine. As mining has progressed below the 7th Level elevation, many raises in the orebody that served for both mining and ventilation purposes have been lost as airways between the 8th and 7th Levels. However, two raises between these levels still serve as ventilation connections and a third raise in the footwall west of the deposit is the permanent connection for ventilation between the two lower levels. Due to the short remaining life of the mine, no additional rock ventilation connections will be driven between the levels because adequate ventilation can be provided all the areas through the present openings.

8. COST OF OPERATING

a. Comparative Mining Costs

	<u>1946</u>	<u>1945</u>
Product - Tons	247,853	326,633
Underground Costs	1.658	1.703
Surface Costs	.229	.231
General Mine Expense	.357	.389
Cost of Production	2.244	2.323
Depreciation	.193	.180
Taxes	.036	.056
Loading and Shipping	.051	.073
Total Cost at Mine	2.524	2.632
Budget Estimated at Mine	2.607	2.850
No. of Shifts & Hours	3, 1-8 Hr.	8, 1-8 Hr.
Total Operating Days	218	292, 2-8 Hr.
Average Daily Product	1,137	300

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8. COST OF OPERATING (Cont.)

b. Detailed Cost Comparison

	<u>1946</u>		<u>1945</u>	
	<u>Amount</u>	<u>Per Ton</u>	<u>Amount</u>	<u>Per Ton</u>
1. Exploring in Mine	6,262.23	.025	10,366.88	.032
3. Development in Rock	327.78	.001	6,674.11	.020
4. Development in Ore	33,342.94	.135	38,364.01	.118
5. Stopping	145,722.86	.587	208,286.45	.638
6. Timbering	114,134.95	.460	155,558.26	.476
7. Trammig	45,494.20	.184	44,488.24	.136
8. Ventilation	2,352.66	.009	2,791.19	.009
9. Pumping	8,071.57	.033	12,075.95	.028
10. Compressors & Air Lines	18,186.38	.073	21,560.93	.066
12. Underground Superintendence	20,166.23	.081	23,927.88	.073
14. Maint: Comp. & Power Drills	990.49	.004	887.15	.003
15. Scrapers & Mech. Loaders	6,073.15	.025	12,173.12	.037
16. Elec. Tram Equipment	9,333.51	.038	18,073.80	.055
17. Pumping Machinery	673.61	.003	1,032.58	.003
Total Undg. Costs	<u>411,132.56</u>	<u>1.658</u>	<u>556,260.55</u>	<u>1.703</u>
18. Hoisting	19,668.86	.079	27,849.51	.085
19. Stocking Ore	8,406.51	.035	9,345.41	.029
20. Screening-Crushing at Mine	290.14	.001	219.46	.001
21. Dry House	10,105.37	.041	10,713.70	.033
22. General Surface Expense	9,931.83	.040	11,990.48	.037
23. Maint: Hoisting Equipment	4,782.68	.019	9,814.56	.030
24. Shaft	1,716.81	.007	2,281.43	.007
25. Top Tram Equipment	1,006.79	.004	2,090.49	.006
26. Docks, Trestles & Pockets	737.17	.003	623.08	.002
27. Mine Buildings	98.31	.000	466.95	.001
Total Surface Costs	<u>56,744.47</u>	<u>.229</u>	<u>75,395.07</u>	<u>.231</u>
Vacation Expense	18,625.70	.075	17,295.40	.053
28. Insurance	2,533.94	.010	3,214.24	.010
29. Mining Engineering	1,834.49	.007	3,187.23	.010
30. Mech. and Elec. Engineering	739.55	.003	1,109.69	.003
31. Analysis & Grading	8,292.39	.033	16,361.92	.050
32. Personal Injury	13,704.71	.055	24,653.71	.075
33. Safety Department	1,214.89	.005	1,502.39	.005
34. Tel. & Safety Devices	1,942.33	.008	3,026.43	.009
35. Local & Gen. Welfare	3,111.00	.013	5,695.97	.017
36. Special Expense and Allow.	2,951.06	.012	5,343.51	.016
37. Ishpeming Office	10,530.66	.042	14,591.62	.045
38. Social Security	8,579.20	.035	11,506.09	.035
39. Mine Office	14,678.53	.060	18,291.41	.056
Annuities	319.13	.001	1,481.62	.005
Total Gen. Mine Expense	<u>88,219.32</u>	<u>.357</u>	<u>127,261.23</u>	<u>.389</u>
Cost of Production	556,296.35	2.244	758,916.85	2.323

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8. COST OF OPERATING (Cont.)

b. Detailed Cost Comparison (Cont.)

	<u>1946</u>		<u>1945</u>	
	<u>Amount</u>	<u>Per Ton</u>	<u>Amount</u>	<u>Per Ton</u>
41. General Supplies	12,962.49	.052	13,378.34	.041
42. Iron & Steel	6,117.41	.025	4,917.39	.015
43. Oil & Grease	1,084.59	.005	1,113.14	.003
44. Machinery Supplies	6,126.03	.025	6,575.13	.020
45. Explosives	13,980.22	.056	20,233.79	.062
46. Lumber & Timber	25,614.74	.103	38,437.02	.118
47. Fuel	2,206.09	.009	2,657.86	.008
48. Electric Power	29,518.28	.119	42,487.13	.130
49. Sundries	8,803.12	.035	27,668.55	.085
50. Other Mines & Accounts	-	-	146.76	
Total Supplies	106,413.17	.429	157,321.59	.482

The following table shows the maintenance expense during the idle period on account of the strike:

<u>Month</u>	<u>Amount</u>
February	10,949.15
March	15,248.73
April	14,173.42
May	10,882.14
Total	51,253.44

The above costs cover the period from February 8 to May 22, 1946.

The following are explanations of operating costs that show significant variations compared with the previous year:

1. Exploring in Mine

The decrease in expenditures in this account is due to a smaller diamond drilling program. The cost however did not decrease in proportion to the smaller exploration program because of the large increase in diamond bit cost and labor.

3. Development in Rock

The large decrease is due to the small rock development program compared to the previous year.

4. Development in Ore

A smaller ore development program was conducted but the cost per ton is higher due to the increase in wages.

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8. COST OF OPERATING (Cont.)

b. Detailed Cost Comparison (Cont.)

5. Stoping

The decrease in this account is due to a larger proportion of the product mined by stoping and caving methods.

	<u>1946</u>		<u>1945</u>	
	<u>Amount</u>	<u>Per Ton</u>	<u>Amount</u>	<u>Per Ton</u>
General Supplies	5,750.98	.023	6,379.77	.020
Iron and Steel	3,831.92	.015	1,543.42	.005
Oil and Grease	156.89	.001	189.96	.001
Machinery Supplies	745.16	.003	454.87	.001
Explosives	11,556.04	.047	16,420.42	.050
Electric Power	3,740.88	.015	4,118.59	.013
Sundries	3,273.30	.013	4,847.92	.015
Expense Accounts	800.43	.003	836.17	.003
Total	28,365.28	.114	34,791.12	.108

	<u>1946</u>		<u>1945</u>	
	<u>Amount</u>	<u>Per Ton</u>	<u>Amount</u>	<u>Per Ton</u>
Payroll Labor	110,135.26	.444	163,833.15	.501
Cliffs Shaft Labor	-	-	2.88	-
General Shops Labor	1,070.27	.004	1,841.92	.005
Shops, Labor, etc	6,144.19	.025	7,817.38	.024
General Storehouse	7.86	-	-	-
Total Labor	117,357.58	.473	173,495.33	.530

Grand Total 145,722.86 .587 208,286.45 .638

Production Tons Stopped	225,904	302,758
Avg. Miners Rate Stopping	10.85	8.46
Avg. Tons Per Man Stopping	24.58	20.86

6. Timbering

The decrease is due to stoping and caving methods being employed to a larger extent.

7. Tramming

The increase in expense in this account is due to the higher cost of labor and charging scraper operators time in each of the stope transfer drifts to this account. Also, it was necessary to maintain tramming operations on the 7th Level for a large part of the year for a small number of contracts until the ore above this level was depleted.

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8. COST OF OPERATING (Cont.)

b. Detailed Cost Comparison (Cont.)

9. Pumping

The cost per ton was higher despite a decrease in the mine water because of the increase in wages. Approximately 46% of the water was again diverted to the Morris Mine and the charges by the Inland Steel Company for pumping this water decreased because of the smaller proportion of Lloyd water to their total volume. The following is a comparative statement of the pumping charges for the past five years:

Year	Total Inland Steel Co.			C.C.I. Co. Prop.		
	Amount	Percent	Avg. Gals Per Min.	Amount	Percent	Avg. Gals Per Min.
1946	43,090.37	91.4	887.4	5,600.69	8.6	83.5
1945	43,150.99	89.9	857.6	6,518.28	10.1	96.8
1944	59,011.80	91.6	887.9	5,393.50	8.4	83.1
1943	64,159.88	89.9	932.0	6,577.81	10.1	104.9
1942	42,644.22	86.0	847.1	7,013.13	14.0	101.0

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

	Average Gallons per Minute	
	1946	1945
Second Level Water Supply	32.1	31.7
Fifth Level Water Supply	64.4	82.6
Seventh Level to Morris Mine	83.5	96.8
Total	180.0	211.1

There was a large drop in the amount of water pumped during the year due to the light snow fall and quick spring break-up. A peak volume of 258.0 G.P.M. was reached in April which is considerably lower than the peak reached in other years after the spring break-up.

10. Compressors and Air Lines

The increase in cost per ton is due to higher labor and supply costs.

12. Underground Superintendence

The supervisory force was reduced by transferring one shift boss to another mine at the close of the year and a timber foreman was taken off at the close of the previous year. An underground sub foreman was retired in 1946 and this vacancy was not filled. The increase in cost per ton is due to increasing the salaries of the bosses and payment of a \$150.00 bonus to each boss at the close of the year.

15. Maintenance of Scrapers & Mech Loaders

16. Electric Tram Equipment

A large decrease in these accounts is due to the reduction in the size of the underground operation with a corresponding decrease in the amount of equipment used and requiring maintenance.

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8. COST OF OPERATING (Cont.)

b. Detailed Cost Comparison (Cont.)

17. Pumping Machinery

The decrease is due to less repairs and no new equipment purchased.

18. Hoisting

The cost per ton decreased slightly despite the increase in wages due to a large reduction in power costs resulting from a better power factor.

19. Stocking Ore

The increase is due to more trestle construction required for stocking Silica grade because of the small shipment of this grade.

21. Dry House

22. General Surface Expense

The cost per ton in these accounts was higher due to the increase in wages. The labor force on surface was reduced in June and again at the close of the year to keep it in line with the reduced size of the underground operation.

23. Maintenance of Hoisting Equipment

24. Shaft

25. Top Tram Equipment

The cost in the above accounts was less despite the wage increase because considerably less maintenance and repairs were required.

28. Vacation Expense

The large increase in this expense is due to the wage increase and more employees eligible for vacation pay.

29. - 38. Inclusive

There was a general decrease in the cost per ton in nearly all of the above accounts due to a smaller proportion of direct charges as the labor force and underground operation decreased in size.

9. EXPLORATION AND FUTURE EXPLORATIONS

There was very little drilling done in 1946 and not until late in the year was a program started to explore the structure south of the main orebody. No previous drilling had been done in this area from underground or surface and before operation of the mine is suspended due to depletion of reserves, several holes will be drilled to explore the area. The first hole was completed from the end of the south crosscut on the 8th Level but no concentration was disclosed and a second hole was started late in December and it is being drilled to explore the same structure below the level. Early in 1947, a short run of high grade ore

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9. EXPLORATION AND FUTURE EXPLORATION (Cont.)

was penetrated in the second hole and several dikes and a substantial amount of iron formation was crossed. Additional holes will be required to more thoroughly explore the structure that has been developed despite the fact that the information to date does not justify a very optimistic outlook. The structure to the east and south of the Lloyd Deposit has been extensively drilled over the past several years and only short insignificant runs of ore were encountered in some holes. The possibility of finding new ore that will give the mine a new lease on life appears now to be very remote.

The following is a table showing the cost of the drilling during the year:

	<u>Feet</u>	<u>Cost Per Foot</u>	<u>Total</u>
Deep Hole Drill	866'	\$7.231	\$6,262.23

The following is a log of the drilling:

<u>D.D.H. No. 176</u>		
<u>8th Level - Dip 0° - Due South</u>		
<u>Depth</u>	<u>Material</u>	
0' - 239'	Tr. Jas. & Slate	
239' - 365'	S. O. J.	
365' - 370'	Lean Ore	
370' - 496'	S. O. J.	
496' - 501'	Dike	
501' - 522'	S. O. J.	
522' - 554'	Diabase Dike	
554' - 559'	S. O. J.	
559' - 560'	Dike	
560' - 598'	S. O. J.	
598' - 601'	Dike	
601' - 624'	S. O. J.	
624' - 630'	Slate	
630' - 658'	S. O. J. (Completed)	

<u>D.D.H. No. 177</u>		
<u>8th Level - Dip 46° - Due South</u>		
<u>Depth</u>	<u>Material</u>	
0' - 15'	Greywacke	
15' - 208'	Sl. & Greywacke	

(Not Completed)

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10. TAXES

The following shows a comparison of the taxes paid in 1946 and 1945 in Ishpeming Township:

	<u>1946</u>		<u>1945</u>	
	<u>Valuation</u>	<u>Taxes</u>	<u>Valuation</u>	<u>Taxes</u>
<u>Lloyd & Section 6</u>				
SW $\frac{1}{4}$ of NW $\frac{1}{4}$ of Sec. 6, 47-27)				
40 Acres, N $\frac{1}{2}$ of SW $\frac{1}{4}$ of Sec. 6)				
47-27, 81.67 Acres, N $\frac{1}{2}$ of SW $\frac{1}{4}$)				
of Sec. 6, 47-27, 80 Acres	405,000	6,464.04	685,000	12,537.97
Personal, Ore in Stock,				
Supplies and Equipment	445,000	7,102.20	305,000	5,582.60
Total by State Tax Comm.	850,000	13,566.24	990,000	18,120.57
Collection Fees		135.66		181.21
Total Taxes		13,701.90		18,301.78
<u>CCICo. Misc. Lands</u>				
S $\frac{1}{2}$ of NE $\frac{1}{4}$ of Sec. 6, 47-27	320	5.12	320	5.86
SE $\frac{1}{4}$ of NW $\frac{1}{4}$ of Sec. 6, 47-27	350	5.59	350	6.41
S $\frac{1}{2}$ of SW $\frac{1}{4}$ of Sec. 6, 47-27	700	11.18	700	12.81
SW $\frac{1}{4}$ of SE $\frac{1}{4}$ of Sec. 6, 47-27	350	5.59	350	6.41
SE $\frac{1}{4}$ of SE $\frac{1}{4}$ of Sec. 6, 47-27	575	9.18	575	10.52
Total	2,295	36.66	2,295	42.01
Collection Fees		.37		.42
Total CCICo. Misc. Lands		37.03		42.43
Total Lloyd	852,295	13,738.93	992,295	18,344.21
Taxes Lot 4, Block 2, West Ish.)				
Lots 19 & 20, Block 9)	250	4.04	50	.93
<u>North Lake Dwellings</u>				
Houses on Sec. 6, 47-27	4,500	71.82	4,500	82.37
Collection fees		.72		.82
Total Dwellings		72.54		83.19
Total Ishp. Township	857,045	13,815.51	996,845	18,428.33
Rate		1.596		1.830

The decrease in taxes is due to the large reduction in valuation as the tonnage of reserves is being depleted. The valuation on personal property was higher but this was offset by the reduced valuation on reserves and the lower tax rate.

	<u>1946</u>	<u>1945</u>	<u>1944</u>	<u>1943</u>	<u>1942</u>
Taxes per ton produced	.056	.056	.052	.049	.069
Taxes per ton shipped	.069	.054	.070	.043	.067

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11. ACCIDENTS AND PERSONAL INJURY

The accident frequency and severity rate was worse than in the previous year. There were ten compensable accidents, the same number as in the previous year, and one of these was of a serious nature. Another injury which was very minor in nature preceded a chain of events that terminated in the death of the employee four months later. This employee suffered a slight injury to his chest and later contracted pneumonia and pluresey which caused his death four months after the accident. Death is thought to have resulted from a malignant growth which had no connection with the accident and it is very likely that determination of liability will have to be settled in court.

The total man days worked was considerably less due to the strike and reduction in the size of the labor force. The man days worked in 1946 were 41,966 compared with 62,270 in the previous year. The man days lost on account of all accidents was 480 and for compensable accidents 454 man days were lost.

The following table shows a comparison of the accident frequency and severity rate for the past two years:

<u>Year</u>	<u>Frequency Rate</u>	<u>Severity Rate</u>
1946	56.60	1.43
1945	20.07	1.154

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

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

The compensable accidents are listed in detail as follows:

Accident No. 862, January 6, 1946, William T. Anderson, Contract Miner. While moving a piece of timber into an old slice he lost his footing and fell back against a pole protruding from the back of the slice. - Bruised back. - Time lost - 24 days.

Accident No. 863, February 6, 1946, Emil Verlin, Timberman. While walking along the road leading to the dry house on his way to work he slipped and fell injuring his right ankle. - Sprain of right ankle. - Time lost - 24 days.

Accident No. 864, July 3, 1946, Arnold Heikkila, Company Account Miner. While loading a car at the chute a sudden rush of wet ore rocked the edge of the car against his knee. - Contusion of right knee. - Time lost - 9 days.

Accident No. 865, August 21, 1946, William H. Williams, Contract Miner. A piece of ore fell from the back of the bench in a stope striking him on the right shoulder and wrist. Fractured right wrist and bruised shoulder and back. - Time lost - 114 days.

Accident No. 866, August 22, 1946, George Brighenti, Truck Driver. While shoveling sand into the truck he suffered a strain in the back. - Back strain. - Time lost - 33 days.

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11. ACCIDENTS AND PERSONAL INJURY (Cont.)

Accident No. 867, September 29, 1946, Jacob Pantti, Sr., Policeman. He bumped his forehead on the ladder rail as he was descending the vertical steel ladder on the side of the reservoir tank. - Swelling of forehead and discharge matter from both eyes. - Time lost 79 days.

Accident No. 868, October 17, 1946, Chester Uren, Motorman. As Uren was passing by No. 807 Raise with the motor train a small piece of ore fell down the ladder road and struck him on the right side of the chest. - Bruised chest. This employee died four months after the accident after contracting pneumonia and pluresey. Determination of liability pending.

Accident No. 869, October 28, 1946, Victor LaForge, Contract Miner. He was barring a mill raise in which the ore was hanging up and a piece fell down along the bar and struck him on the wrist on the right hand. Simple fracture of right radius. - Time lost - 41 days.

Accident No. 870, November 21, 1946, Arthur Larson, Carpenter. Larson and a helper were rolling a crooked 18' timber on to the skids so it could be framed. One end of the log struck a projecting part of the skid pole causing it to up-end and swing around and strike him in the back. - Contusion lumbar region and fracture transverse process third lumbar. - Time lost - 34 days.

Accident No. 871, December 4, 1946, Joseph Stagliano, Track Cleaner. He had lashed several length of short plank to be hoisted up No. 808 Raise. After he gave the signal to hoist the material, it was pulled into the raise and the end of a plank caught on a cribbing close to the level and when he attempted to pull the load free, the load swung and struck him in the buttox. - Bruised left side of buttox. - Time lost - 12 days.

12. NEW CONSTRUCTION AND PROPOSED NEW CONSTRUCTION

There was no new construction during the year and none is planned or anticipated in the coming year. Erection of 24 bents of wood trestle for stocking Lloydale grade to the east of the shaft and five bents of trestle to the west of the shaft for Silica grade comprised the only construction work on surface. There was no new construction underground other than some preliminary work in connection with the 9th Level development which was abandoned.

13. EQUIPMENT AND PROPOSED EQUIPMENT

There were no large items of new equipment purchased during the year. Due to the continual decrease in the size of the operation there is a surplus of some equipment. Two scraper hoists, four drill machines and seven 65 cubic foot rocker dump ears were sold to the Cambria Mine. There was one General Electric haulage motor and four DA-35 drifting machines transferred to the Spies Virgil Mine. More usable equipment will become available for transfer to other mines before operations are suspended. Much of the surplus equipment is obsolete and some of it is worn out and of necessity this will be scrapped. Due to the short remaining life of the mine the purchase of new equipment is limited to items of immediate need.

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13. EQUIPMENT AND PROPOSED EQUIPMENT (Cont.)

The following is the new equipment added to the inventory in 1946:

<u>Number of Items</u>	<u>Items</u>	<u>Cost</u>
1	R. C. Allen Adding Machine Model 905-1056145	\$174.90

14. MAINTENANCE AND REPAIRS

a. Mine

The maintenance and repair expense was less despite the wage increase because of the decrease in the size of the operation. Surface buildings required practically no repairs and most of the maintenance was confined to equipment. The stoker for the dry house heating plant required some replacement parts to keep it in good operating condition. In the shaft house repairs consisted mostly of replacing worn out plate in the skip dumps and the chutes below the dumps. The skip dumps were completely rebuilt two years ago and consequently repairs to them have been at a minimum during the past two years. The skip hoist motor required overhauling and several weekend periods were taken to complete the work. A number of coils have been shorted out to keep the motor in operating condition and it has been necessary to install shims that are made especially for this purpose between the coils in the field winding to reduce the vibration which has caused breaks in the coils.

Repair work in the shaft has been continued at about a normal rate replacing worn out runners where necessary and placing hardwood wearing strips on the sides of the runners in the skip roads. Some new casing plank was installed in the upper part of the shaft, replacing rotted casing. Shaft inspections are being made regularly on weekends and in the middle of the week and this has been an important factor in preventing break-downs in the shaft.

Repairs in underground timbered drifts have been confined mostly to the 7th and 8th Levels. Before mining reached the last sub levels above the 7th Level a large amount of repairs were required to maintain the south footwall drift open for tramping. As soon as mining from 8th Level raises could be started portions of the 7th Level were abandoned reducing the amount of repair work on this level. On the 8th Level, lining sets have been installed throughout the portion of the haulage drift that is in ore. The hardwood timber that was installed when the drift was driven about three and one-half years ago is badly rotted and this necessitated the installation of the lining sets.

Repairs in mining raises have diminished as the length of the raises above the 8th Level have become progressively shorter. In most cases the work consisted of relining the chute compartment with hardwood plank. During the early part of the year when a larger underground repair program was required, crews were organized for work on weekends but later in the year, with few exceptions, it was possible to eliminate the weekend work. Most of the repair work at the close of the year was being conducted during the midnight shift when no tramping operations are being conducted.

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14. MAINTENANCE AND REPAIRS (Cont.)

b. Location

1. General Maintenance

The cost of the location maintenance was considerably higher due to the increase in wages. The largest item of expense is operation and maintenance of the water supply system to which account a proportion of the underground pumping expense is charged. Approximately one-half of the water supply is still being obtained from the second level and the other half from a Morris Mine surface well. It became necessary to lay 540' of new water line to replace an old $\frac{3}{4}$ " line that was not large enough to supply adequate pressure in several homes on one street. Approximately one-half of the new line was 2" diameter pipe and the other half $1\frac{1}{2}$ " size. One bad leak developed in a section of the 6" water main in the location and it was necessary to dig a substantial amount of ditch to locate the break and make the repairs.

	<u>Labor</u>	<u>Supplies</u>	<u>Total</u>
Water	-	4,218.34	4,218.34
Water Mains	50.06	24.33	74.39
Cleaning	31.92	-	31.92
Water Piping	371.47	150.27	521.74
Xmas Tree	3.61	4.44	8.05
Total	457.06	4,397.38	4,854.44

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

<u>Year</u>	<u>Amount</u>
1946	4,854.44
1945	3,464.61
1944	4,358.71
1943	4,433.54
1942	4,439.13

2. Rented Buildings

Maintenance of rented buildings has decreased because all the dwellings excepting one have been sold. The small expenditure for repairs was confined almost entirely to minor repairs that were made to the Mather Mine Superintendent's house.

The remaining dwelling in the location was sold during the year to the tenant who is an employee at the mine. This house was half of a duplex, the other half of which had been sold previously.

There was very little repairs done on the store building that is being rented but in 1947 some rewiring of the electrical circuits and repairs to the front of the building will have to be made. The building will also need painting to put it in good condition

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14. MAINTENANCE AND REPAIRS (Cont.)

2. Rented Buildings

The following is a comparison of the expenditures on rented buildings for the past five years:

<u>Year</u>	<u>Amount</u>
1946	92.22
1945	403.95
1944	3,290.52
1943	737.91
1942	360.90

The club house in the location was closed on July 1st. The large annual operating deficit together with the gradual decline in the patrons who made use of its facilities made it advisable to take this action. There is no plan to reopen the building in the future and the windows have been boarded up and the power and water shut off. Most of the furnishings have been donated to a local church organization. One basement room has been let for use to a local club and they have provided for their own lighting and heating.

<u>Year</u>	<u>Proportion of Operating Deficit</u>		<u>Total</u>
	<u>Lloyd Mine</u>	<u>Inland Steel Co.</u>	
1946	2,076.03	480.00	2,556.03
1945	2,785.33	960.00	3,745.33

15. POWER

There were no delays to operations due to the lack of electrical power. The large decrease in power consumption and cost is due to the strike and because of the reduction in the size of the mine operation. The following is a five year comparison of power consumption:

<u>Year</u>	<u>K.W.H.</u>	<u>Cost</u>	<u>Rate</u>
1946	2,011,200	29,830.08	.0148
1945	2,937,800	43,337.04	.0148
1944	3,090,000	44,655.12	.0145
1943	3,633,600	50,699.76	.0139
1942	3,751,200	52,200.96	.0139

16. WATER SUPPLY

The demand for water has continued at about the same rate as in the previous year and the source of supply is about equally divided between the surface well at the Morris Mine and the 2nd Level. Effective October 1st, the monthly rate for water was increased to all the customers. A rate of \$6.00 per year per family had been in effect since the service was instituted and to bring the rates in line with other municipalities a scale of rates ranging from \$9.00 to \$12.96 per year depending upon the number of taps was put into effect. Minor repairs and replacement of some worn out parts was necessary to keep both chlorinators in good operating condition. Upon recommendation of the Health Officer the amount of chlorine introduced was increased about 200% because some contamination was discovered in the water during a short period in the summer. Since more chlorine is being added, no further trouble from contamination has been experienced.

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17. CONDITION OF PREMISES

The premises have been kept in good condition and in the summer months the lawn and flower garden particularly have been very attractive. The shrubbery and trees have been pruned and continue to show a health growth.

18. NATIONALITY OF EMPLOYEES

	<u>American Born</u>	<u>Foreign Born</u>	<u>Total</u>	<u>Per Cent</u>
Finnish	42	22	64	38
Italian	12	22	34	20
French	29	0	29	17
English	14	1	15	9
Swedish	13	2	15	9
Norwegian	5	0	5	3
Austrian	2	1	3	2
Irish	2	0	2	1
Manxman	0	1	1)	1
German	1	0	1)	1
	120	49	169	100

MATHER MINE
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1. GENERAL:

Operations during the sixth year since the beginning of shaft sinking were very satisfactory in spite of the strike which lasted from February 8th until May 22nd, a period of three and one-half months. With the natural unrest immediately preceding and following the strike, the total loss was the equivalent of four months, or one-third of the year. The production was 339,433 tons as compared with 203,091 in 1945, an increase of 67%; and would have been in the neighborhood of 500,000 except for the lost time.

The strike, which was called by the C.I.O. in violation of the contract, was against the will of a great majority of the local men. In spite of this, the affair was peaceable enough until late in March when the union refused to permit maintenance employees to enter the plant. Following a circuit court injunction designed to protect these men, a strong "Back-to-Work movement" started on the 21st and precipitated a large number of mass demonstrations with the usual mob violence. A substantial number of Mather employees were too stubborn to be stopped by these tactics and continued to report for work throughout the remainder of the strike in spite of determined efforts to stop them and practically no police protection. The affair was serious enough in the eyes of the union to warrant sending in some of the best "talent" in the country, the most well known of which was John V. Riffe, alias Vernie Rife, of the Republic Steel strike of several years ago. He and a number of his less famous lieutenants left town, after his arraignment on three felony charges revealed a quite varied federal "record". The mobs included only a few Mather employees, the rest being recruited from other mines in the district. Following the settlement, which included the much publicized 18½ cent increase, the return to normal was very rapid due to the fine condition in which the mine had been kept, and the attitude of practically all the employees. There was very little of the usual aftermath and no serious trouble.

In the fall elections, the people of the whole district expressed their opinion of the strike violence and "new deal" tactics by electing a solid republican ticket both local and national except for the local prosecutor who survived by a few votes. Even the recognized "mouthpiece" of the C.I.O., congressman Frank E. Hook of the 12th Michigan district, was defeated by a large majority as was Alvin Hampton, State Senator and an active CIO organizer in Negaunee.

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1. GENERAL:(Continued)

Pocket shipments were started immediately following the strike and continued throughout the balance of the season. Stockpile shipments were started in June and completed in October with both grades cleaned up. This permitted the placing of the concrete piers for the extensions to the trestles which will be erected in 1947.

Throughout most of the year the 2nd Level was the major producing level; but by December, ore was being obtained from the 3rd and 5th Levels in increasing amounts. The average monthly production was 42,400 tons with a high in October of 55,123 including pocket overrun.

For the first time since the completion of shaft sinking, there was an adequate supply of both skilled and unskilled labor with the result that the crew was built up to 350 men by the end of the year.

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2. PRODUCTION,
SHIPMENTS &
INVENTORIES:

a. Production by Grades:

	<u>Product</u>	<u>1946</u>		<u>1945</u>	
		<u>Transfers</u>	<u>Stockpile Overrun</u>	<u>Total</u>	<u>Total</u>
Mather	200,416	4,974	1,879	207,269	112,541
Mather Special	134,216	4,974	2,922	132,164	90,550
Total	334,632	0	4,801	339,433	203,091
Rock				83,045	57,057

b. Shipments:

<u>Grade of Ore</u>	<u>Pocket Tons</u>	<u>Stockpile Tons</u>	<u>Total Tons</u>	<u>Total</u>	
				<u>1945</u>	<u>1944</u>
Mather	125,925	37,351	163,276	104,834	33,404
Mather Special	95,240	58,835	154,075	63,371	7,436
Total	221,165	96,186	317,351	168,205	40,840

Stockpile inventories of both grades were cleaned up during September and October. Year end figures are the amounts produced after the end of the shipping season.

c. Stockpile Inventories:

	<u>1946</u>	<u>1945</u>
Mather	57,949 Tons	13,956 Tons
Mather Special	12,900 "	34,811 "
Total	70,849 Tons	48,767 Tons

d. Division of Product by Levels:

	<u>Mather</u>	<u>Mather</u>	<u>Total</u>
	<u>Special</u>	<u>Special</u>	<u>Tons</u>
Second (1600') Level	115,819	123,839	239,658
Third (1750') Level	1,042	8,913	9,955
Fifth (2050') Level	81,332	1,464	82,796
Sixth (2200') Level	2,223	-	2,223
	200,416	134,216	334,632
Transfers	4,974	4,974	0
Stockpile Overrun	1,879	2,922	4,801
Total	207,269	132,164	339,433

By the end of the year the largest mining area above the 2nd Level was finished and production above the 3rd and 5th was greatly increased.

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2. PRODUCTION,
SHIPMENTS &
INVENTORIES:
(Continued)

e. Production by Months:*

<u>Months</u>	<u>Mather</u>	<u>Mather Special</u>	<u>Total</u>	<u>Rock</u>
January	16,752	15,341	32,093	6,468
February	4,176	2,231	6,407	1,342
March	360	1,932	2,292	209
April	24	1,357	1,381	-
May	3,265	3,562	6,827	1,436
June	12,496	20,724	33,220	7,579
July	21,865	11,301	33,166	9,702
August	21,249	20,516	41,765	12,749
September	22,502	15,883	38,385	10,791
October	37,276	17,847	55,123	13,431
November	34,888	8,944	43,832	10,395
December	30,537	9,604	40,141	8,943
Total	205,390	129,242	334,632	83,045
Current Year				
Stockpile Overrun	1,879	2,922	4,801	
	207,269	132,164	339,433	

* Including Net Transfers: Mather + 4,974, Mather Special -4,974

f. Ore Statement:

	<u>Mather</u>	<u>Mather Special</u>	<u>Total</u>	<u>Total Last Year</u>
On Hand January 1, 1946	13,956	34,811	48,767	13,881
Output for Year	200,416	134,216	334,632	201,309
Transfers	4,974	4,974	-	-
Overrun	1,879	2,922	4,801	1,782
Total	221,225	166,975	388,200	216,972
Shipments	163,276	154,075	317,351	168,205
Balance on Hand	57,949	12,900	70,849	48,767
Increase in Output	104,931	28,392	133,323	146,588
Increase in Ore on Hand			22,082	34,886

Working Schedule:

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

* Main Level Development 3-8 hr. shifts, 6 days per week.

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

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

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

1942 - 3-8 hr. shifts, 5-2/3 days per week, Jan. 1st to Dec. 31st, 1942.

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2. PRODUCTION,
SHIPMENTS &
INVENTORIES:
(Continued)

g. Operating Delays:

The only operating delay of any consequence was the strike period February 8th to May 21st inclusive. During that period 3,673 tons were hoisted and stocked.

Loss of product estimated at 160,000 tons.

3. ANALYSIS:

a. Average Mine Analysis on Output:

<u>Grade</u>	<u>Iron</u>	<u>Phos.</u>	<u>Silica</u>	<u>Sulphur</u>
Mather	60.80	.108	6.80	.041
Mather Special	60.19	.108	7.36	.160

b. Average Analysis on Straight Cargoes:

All of the shipments during 1946 were in mixed cargoes.

c. High Sulphur Ore:

The high sulphur ore above the 2nd and 3rd Levels continued to be produced in the areas described in last year's report without any important changes. The grading limit of the Mather product was continued at .050, which permitted mixing thousands of tons for hoisting as Mather grade which otherwise would have been graded as Special.

Until late in the year no high sulphur ore was found on or above the 5th and 6th Levels. However, in September occasional, spotty sulphurous areas were encountered in a transfer drift on the -475' sub-level. The average in this drift, which was driven east and west along the footwall, was well within the .050 grading limit. Development above and to the north of this drift, however, disclosed an area consistantly high, with occasional samples in excess of 1.000%. This deposit, containing several hundred thousand tons, is confined to an area above the -475' elevation, north of the dike, east of the main fault, and between #2 and #3 Cross-cuts.

A second high sulphur area containing a much smaller tonnage was encountered in November at a much higher elevation but in the same structure west of the fault above #1 Cross-cut. The bottom of this ore is at the -390' elevation almost 200' above the 5th Level. Development to date has been confined to a few feet of test drifting, all of which showed sulphur too high for the Standard product.

d. Complete Analysis of Ores in Stock:

	<u>Iron</u>	<u>Phos.</u>	<u>Silica</u>	<u>Mang.</u>	<u>Alum.</u>	<u>Lime</u>	<u>Mag.</u>	<u>Sulph.</u>	<u>Loss</u>	<u>Moist.</u>
Mather	60.90	.102	7.06	.21	2.84	.57	.55	.045	1.94	11.50
Mather Special	60.14	.103	7.75	.16	2.60	.75	.49	.106	1.82	11.50

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4. ESTIMATE AND ANALYSIS OF ORE RESERVES:

Once again the estimate was made by augmenting, with underground information, the original estimate made from the surface drill hole sections. This year, however, the underground estimate was made from plan maps instead of from sections as in former years. As a result, the reserves developed by underground operations can now be shown by levels.

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

	<u>Mather Standard</u>	<u>Mather Special</u>	<u>Total Underground</u>	<u>Diamond Drilling</u>	<u>Total Tons</u>
Reserves Indicated By Surface Diamond Drilling (Same as 1944).....	7,990,818			7,990,818	
Reserves Indicated By Underground Development:					
Above 2nd Level...	577,606	333,721	911,327		
Between 2nd & 3rd Levels.....	68,177	328,042	396,219		
Above 5th Level...	1,478,582	143,394	1,621,976		
Between 5th & 6th Levels.....	<u>2,042,854</u>	-	<u>2,042,854</u>		
Total Gross as of November 30, 1946.	4,167,219	805,157	4,972,376	7,990,818	12,963,194
Less December 1946 Production.....	<u>30,537</u>	<u>9,604</u>	<u>40,141</u>	-	<u>40,141</u>
Total Gross as of December 31, 1946.	4,136,682	795,553	4,932,235	7,990,818	12,923,053
Less 10% for Rock and Loss in Mining.....	<u>416,722</u>	<u>80,516</u>	<u>497,238</u>	<u>799,082</u>	<u>1,296,320</u>
Net Total as of December 31, 1946	3,719,960	715,037	4,434,997	7,191,736	11,626,733

The above figures do not include the large tonnages with sulphur content too high for the Special grade.

A comparison with last year's estimate indicates a gross gain, including the production for the year, of 2,000,000 tons in the Mather grade and a loss of 280,000 in the Special grade, a gain of approximately 1,800,000 tons in the reserves indicated by underground operations.

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

	<u>Mather Standard</u>	<u>Mather Special</u>	<u>Total Tons</u>
Net Total Dec. 31, 1946	10,911,696*	715,037	11,626,733
Net Total Dec. 31, 1945	<u>9,040,811</u>	<u>1,127,417</u>	<u>10,168,228</u>
Net Gain in Reserves	1,870,885	412,380	1,458,505
1946 Production	<u>207,269</u>	<u>132,164</u>	<u>339,433</u>
Gross Gain in Reserves	2,078,154	280,216	1,797,938

* Sum of reserves indicated by diamond drilling and underground development.

Expected Average Natural Analysis of Ore Reserves:

<u>Grade</u>	<u>Total Tons</u>	<u>Iron</u>	<u>Phos.</u>	<u>Sil.</u>	<u>Mang.</u>	<u>Alum.</u>	<u>Lime Mag.</u>	<u>Sulph.</u>	<u>Loss</u>	<u>Moist.</u>
Mather by Surface										
Diamond Drilling..	7,191,736	53.15	.122	5.08	.25	2.62	.58	.60	.014	1.97 12.50
Mather by										
Undg. Development.	3,719,960	53.00	.120	6.65	.20	2.40	.80	.50	.044	2.45 11.50
Mather Special by										
Undg. Development.	<u>715,037</u>	53.00	.120	6.65	.20	2.50	1.60	.50	.250	2.00 11.50
	<u>11,626,733</u>									

5. LABOR AND WAGES:

a. Comments

The number of men on the payroll (including Supervisory and office employees) at the beginning of the year was 224. A few were added prior to the strike, but the large gain came immediately following the strike when a back-log of returning veterans and transferees was available. Employment was continued at a rapid rate throughout the rest of the year, with the complete data shown in the table below.

Number of Men January 1, 1946	224
Added to Roll During the Year.....	163*)- (57 New Men (106 Transfers)
Total.....	<u>387</u>
Separations.....	<u>37</u>
Total on Payroll December 31, 1946.	350
Net Gain.....	126

* Including 75 veterans: 13 Mather Veterans
 36 C.C.I. Veterans
 26 New Veterans
 75

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5. LABOR AND WAGES:
(Continued)

a. Comments (Continued)

Most of the new men were hired for underground work; although the surface crew was increased somewhat to take care of the large amount of construction work and the expanding operation. With the exception of several partially disabled veterans who were carefully fitted into jobs within their capabilities, all of the men hired during the year were above the average in both experience and physical fitness.

The period following the strike was the first time since the completion of shaft sinking that sufficient men were available for a full crew. By the end of the year, the force had been built up to the point where main level development work was being carried on three shifts per day; and all developed mining places were being worked two shifts per day. There was still a fair back-log of available labor to be drawn on as new mining areas were opened.

The contract with the C. I. O. was continued with the exception of the strike period when it was declared breached and void. In spite of the bad feeling due to violence during the "back to work movement", there was very little trouble following the final settlement. Several attempts were made by a few "die-hards" to stir up trouble. The men involved were disciplined promptly and effectively with the result that there were no further incidents. There were no formal grievances either before or after the strike; although union membership increased from 80 to 85% by the end of the year, due to increasing efforts on the part of the local organizers. No vacations were taken by hourly rate employees due to the loss of time during the strike.

There was no change in the working schedule. Mining was continued on a two shift basis, 6 days per week with main level development on a three shift schedule. In accordance with the supplemental agreement that was the basis for settlement of the strike a wage increase of $18\frac{1}{2}\phi$ per hour was granted and became effective on May 22nd. An increase of 10ϕ per hour, effective March 22nd was offered as a basis for settlement of the strike and this increase was paid to the maintenance men employed during the period from March 22nd to May 22nd. However, this increase was voided by the supplemental agreement and the $18\frac{1}{2}\phi$ increase was applied to rates in effect prior to February 8, 1946. Payment for overtime in excess of 8 hours per day and 40 hours per week and for the designated holidays was continued at rate and one-half; but the double time provision for work on the seventh consecutive day in a scheduled week was discontinued.

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5. LABOR AND WAGES:
(Continued)

a. Comments (Continued)

The 18 $\frac{1}{2}$ ¢ increase resulted in a rate of \$.96 $\frac{1}{2}$ per hour for common surface labor and \$1.00 per hour minimum underground. The company account miner's rate was increased from \$.86 $\frac{1}{2}$ to \$1.05, or \$8.40 per day exclusive of the \$.05 per hour shift differential. The method of contract payment was changed slightly to allow for increases in supply costs, with the old established rates still in use and the wage increase added after calculating. The high contract pay for the year was \$16.92 as compared with \$14.12 per day in 1945, exclusive of overtime and shift differential. The increase in average wages in the following table reflects the wage increase which amounts to \$1.60 per day and averaged \$40.00 per month throughout the year.

b. Comparative Statement of Wages and Product:

	<u>1946</u>	<u>1945</u>
Product	339,433	203,091
<u>Number of Shifts & Hours:</u>	3 1-8 hr. 215 2-8 hr.	7 1-8 hr. 292 2-8 hr. 2 3-8 hr.
Equiv. to	<u>216$\frac{1}{2}$ 2-8 hr.</u>	<u>298$\frac{1}{2}$ 2-8 hr.</u>
<u>Average No. of Men Working:</u>	<u>Idle</u> <u>Operating</u>	
Surface	23-1/4 72-3/4	61-3/4
Underground	17-3/4 165	<u>120-1/4</u>
Total	41 237-3/4	182
<u>Average Wages per Day:</u>		
Surface	\$ 9.33	\$7.66
Underground	<u>11.01</u>	<u>9.75</u>
Total	\$10.50	\$8.90
<u>Wages per Mo. of 25 Days:</u>		
Surface	\$233.25	\$191.50 (25 Days)
Underground	<u>275.25</u>	<u>243.75</u> " "
Total	\$262.50	\$222.50 " "
<u>Tons Per Man Per Day:</u>		
Surface	21.84	
Underground	<u>9.62</u>	
Total	6.71	
<u>Labor Cost Per Ton:</u>		
Surface	\$.427	
Underground	<u>1.144</u>	
Total	\$1.571	
Average Product Stopping	29.61	
Average Wages Contract Miner	\$12.82	Not Available
<u>Total No. of Days:</u>		
Surface	15,542-1/2	24,356-3/4
Underground	<u>35,260-3/4</u>	<u>35,754</u>
Total	50,803-1/4	60,110-3/4
<u>Amount for Labor:</u>		
Surface	\$145,122.79	\$186,765.90
Underground	<u>388,269.00</u>	<u>348,688.38</u>
Total	\$533,391.79	\$535,454.28

Proportion Surface to Underground Men: 1:2.3

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6. SURFACE:

a. Buildings:

Maintenance of the main buildings was of a routine nature, with additional clothes racks, benches and baskets installed from time to time as new men were hired. The approved fire doors between the engine house and the shop and dry wings were not delivered in spite of the fact that the order was placed in 1945. The installation of these doors with the subsequent decrease in insurance rate will probably be accomplished early in 1947.

The larry car repair shed and the sawmill building were completed and in use by the end of the year.

b. Headframe:

The east half of the south railroad pocket was rebuilt according to the new design, prior to the starting of pocket loading in the spring. Experience during the season indicated a few minor changes, after which the operation was very satisfactory. Some work was done on the west half after the close of shipping but the job was not finished due to the fact that the steel crew was working on the east side of the headframe, where an addition now encloses the area adjacent to the large doors into the skip compartments. This enclosure greatly facilitates the maintenance work on the skips which was formerly done out in the weather.

Several major changes in the headframe flow sheet were completed. The main butterfly was replaced by a much larger, heavier one of new design, operated by two 8" air cylinders instead of the single 7". This new equipment, along with redesigned chutes below it, has gone a long way toward eliminating the sticking of the ore which was a major operating problem. Further improvement was obtained by the installation of rubber lining at several spots below the dump and additional changes in the design of the grizzlies. Another major improvement was a very successful rubber lining in the skip bottoms which has eliminated all sticking of ore in the skips and the subsequent need for constant cleaning.

Nothing was done to prevent the formation of ice in the upper part of the headframe since the problem is now being studied as part of the large task of designing a new heating plant for both the mine air intake and the headframe proper.

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6. SURFACE :
(Continued)

c. Stockpiles and Stocking Trestles:

The new tubular columns at the ends of both trestles were completely satisfactory and stood up under the most severe tests without any appreciable distortion. An authorization was then requested for the construction of four additional concrete piers to provide for extensions of 250' to each trestle next year. These were completed between the end of stockpile loading and the beginning of stocking. Further study has indicated the desirability of a third span or 375' on the north trestle, which will require an additional concrete pier. An appropriation for the extensions will be requested early in 1947 for erection prior to the end of the shipping season. Continued experience with stocking from the ends of the trestles and from tracks laid on the piles merely confirmed the previous conclusion that the method is too slow to handle more than a fraction of the production planned for the future. This method, combined with permanent trestles, will undoubtedly handle the required tonnage satisfactory.

The grading of the stocking area was continued to provide room for the season's requirements but was not completed. The work of dismantling the electric shovel, which has been used at the Negaunee Mine for the past several years, was started preparatory to shipping it to this property. The greater capacity and longer digging radius will make loading operations in the high piles much more satisfactory.

d. Landscaping, Roads and Parking Area:

Work on the grounds was confined to maintenance except for a small amount of new work along the west side of the roadway, inside the main gate. A row of trees was planted for the dual purpose of improved appearance and partial protection from the prevailing westerly winds, which pile great quantities of snow in the driveways and parking area. Experience with snow removal indicates the need for more snow fence protection and additional plowing equipment.

Paving was limited to a small amount of maintenance patching and the application of a seal coat to the areas left unfinished the previous year. All of this work was done by the city crew at cost, as was a considerable amount of snow removal.

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6. SURFACE:
(Continued)

e. Timber Tunnels:

A small amount of rock was removed from the open cut in the westerly extension of the west timber tunnel but the completion of the work was again postponed due to the necessity of using personnel and equipment, especially the small crane, on other work.

Early in the summer, the east portal of the east timber tunnel was concreted and drifting was resumed. Due to a lack of trained rock drift men the project was limited to a single shift. In spite of this, progress was excellent until cold fall weather ended the work until next year. Progress was 278' of 10' x 14' untimbered drift to a distance of 309' from the portal and 385' from the completed tunnel at the shaft. The work will be resumed as early as possible next year.

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7. UNDERGROUND:

a. Shaft Sinking:

None.

b. Development:

c. Stoping:

The subjects of "Development" and "Stoping" are so closely related that the discussion is combined in the following account of underground operations by levels and territories.

2nd Level West (-135'):

Operations in this territory, which extends east from #1 Cross-cut to #3, were confined almost entirely to mining and development work incidental to mining. The area above and west of #1 Cross-cut was the first developed at the property and was so wet that little actual mining was possible until this year when it became reasonably dry. A new double transfer system on the -100' and -50' sub-levels was completed early in the year and stoping was carried on during the rest of the year above these transfers and the old ones further south. Most of the mining was done in a large open stope which extended more than 100' above the -50' sub-level to the jasper capping at the +70' elevation. On completion of this stope, the south transfer on the -50' sub-level was extended to the mining limit preparatory to caving the west ends of both transfers. By the end of the year, water conditions were still improving.

2nd Level East (-130'):

The area immediately above and east of #3 Cross-cut was extensively explored several years ago on the -60' and +50' sub-levels from Raises #2010 and #2303. Operations were then stopped due to the large amount of water in the workings. This condition began to improve with the draining of the old Cleveland-Hematite and exploration and development were resumed early in the year. Raise #2303-"B" was continued to the north above the +50' sub-level in Standard ore to the +100' elevation. Raise #2010 was then continued from the -60' to the +50' elevation for ventilation and the handling of supplies. A top timber car-loading transfer was then put in on the -125' sub-level immediately above the level and connected to Raise #2303. Operations were then resumed in #2303-"B" on the +75' sub-level where a transfer drift was driven to the east in what proved to be a rather long, narrow deposit. By the end of the year a stope had been developed above the transfer and mining had exposed the jasper capping at the +140' elevation. This is one of two places above the 2nd Level where any new ore was developed during the year. From the +50' sub-level

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7. UNDERGROUND: (Continued)

b. Development:

c. Stoping:
(Continued)

2nd Level East (-130'): (Continued)

up, the footwall steepens abruptly and the jasper capping intersects it, forming an ore body which is quite narrow to the east and which apparently widens out and pitches downward to the west. Farther east, beyond a large dike the 2nd deposit is pitching downward to the east above #4 and #5 Cross-cuts.

The area above #4 Cross-cut was originally developed and explored from a transfer on the -60' sub-level by means of three raises put up to the +50' elevation. The workings were then abandoned due to the water and not reentered until late this year. A small amount of new ore was developed above this sub-level and mined by the sub-level caving method. At the end of the year a new mining sub was being developed at the +15' elevation where the ore body is still very narrow.

The mining area between #4 and #5 Cross-cuts is a continuation of the same deposit which pitches downward to the southeast. Development last year outlined a rather large ore body on the -85' sub-level, the north half of which was Standard ore and the south half Special. Development above the main transfer on the -85' sub-level was continued by a series of single raises in Standard ore that was soft enough to require cribbing. On the -60' sub-level, the deposit was all Standard ore but much narrower. On the 0' sub-level and above, the ore was too narrow for sub-caving although of excellent grade. Accordingly, a small stope was developed above a transfer on the -35' sub-level from which all of the ore was recovered up to the jasper on the +25' and +50' sub-levels. The stope opening then induced caving and mining was continued throughout the balance of the year using the caving method with great success, on the -35' and -60' sub-levels. By the end of the year, operations on the -85' sub-level in the south half of the deposit had developed a small stope along the west mining limit and north of the dike, where the ore is approximately 50' high.

The ore body continued its downward pitch to the east under the jasper with the low point at elevation -90' between #5 and #6 Cross-cuts. It then rose sharply to a high point of -10' between #6 and #7 Cross-cuts and to +10' near the Jackson line. Mining was continued throughout the year with the caving system and several small stopes from the -50' sub-level down to the level. This territory, which at times accomodated seven mining crews, was the major producing area. Operations were completed in December by the remaining two crews, which finished the recovery of the small amount of ore remaining on the -110' sub-level, immediately above the level.

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7. UNDERGROUND: (Continued)

b. Development:

c. Stoping
(Continued)

3rd Level East (-275')

In the latter part of the year, operations were resumed on the 3rd Level which had been idle for the better part of two years. Two new mining raises, #3708 and #3709, were put up in rock from #7 Cross-cut to the -185' sub-level where a transfer system almost 600' long was driven in Special ore in the bottom of the trough between the footwall and the main dike. By the end of the year, development above the transfer sub had reached the -140' sub-level where the first mining will be done under the 2nd Level territory between #5 Cross-cut and the boundary. From the 2nd Level down, the deposit is not large; and up to now, no mineable reserves have been found south of the dike. A new cross-cut will be necessary some 400' west of #7 to complete the development and mining of the area.

5th Level (-580')

The main drift in the interbedded ore was continued around the curve for #4 Cross-cut and into the interbedded slate a short distance to make room for diamond drilling. The heading was then stopped and drifting was resumed in the footwall east of Raise #5001. The footwall drift was continued to the east to a point approximately 100' beyond the turnout for #6 Cross-cut. A connection was made with #4 Cross-cut for both ventilation and tramming; and #5 and #6 Cross-cuts were advanced to the southeast far enough to permit drilling. By the end of the year a cut-out for a battery charging station had been completed to the northeast between #5 and #6.

Drilling to the south from #4 and #5 Cross-cuts located the interbedded ore and #5 Dike in normal positions. Beyond the dike, south of #4 Cross-cut, the material was badly mixed and only a few short runs of enrichment were encountered. South of #6 Cross-cut, however, an unusually long run of high grade ore was found extending 200' along the course of the hole and lying immediately north of another dike, probably #4 which was originally encountered in #7 Cross-cut on the 3rd Level.

Exploration, development and mining above the level outlined a number of deposits which, in general, are divided by the fault, which strikes northwest and southeast through #2 Cross-cut, and #5 dike which strikes a few degrees north of due east and dips steeply to the south. The fault, which dips steeply to the northeast, caused a horizontal displacement of approximately 100' on the level, and at least 150' vertically in one instance.

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7. UNDERGROUND: (Continued)

b. Development:

c. Stoping:
(Continued)

5th Level (-580'): (Continued)

In the area west of the fault and north of #5 dike, the crotch formed by the interbedded slate and the dike was located just below the -390' sub-level after a large amount of exploratory raising and drifting above #1 Cross-cut. Development for mining will be continued early next year in this deposit, which is Special grade.

West of the fault and south of the dike, both development and mining were quite extensive on and above the -485' sub-level where the ore was first encountered above the interbedded slates.

A large and very successful open stope was developed above a transfer drift southeast of Raise #5211 in which approximately 100' of Standard ore was encountered. This deposit is lying above the slate and under the jasper capping and was almost 100' high in the second stope above the -485' sub-level, which was just opened for mining by the end of the year. Apparently this is the same deposit as the one encountered in the south end of #1 Cross-cut with a south dip and a westerly pitch. All of the ore encountered to date has been Standard grade; and, when originally opened, the area was very wet. By the end of the year the amount of water was much less and was still decreasing.

In the area east of the fault and south of #5 dike, a large, extensive body of Standard ore was completely explored and partially developed and mined during the year. This was the most important producing area above the 5th Level. Development was started by a 300' transfer drift connecting #2 and #3 Cross-cuts on the -570' sub-level, immediately above the level. From this transfer, a series of single, cribbed raises were put up to the south, first to the -550' sub-level and later to the -385'. Mining places were laid out in two main blocks: the first to the south on the -550', and the second to the north on the -485'. The lower block was opened first by means of a series of transfer drifts which outlined an ore body approximately 400' east and west by 250' wide. The deposit pitches upward to the northwest into the crotch between the dike and the fault, and downward to the southeast under the jasper. The area was first opened to the south under the jasper in an attempt to drain the water from the whole deposit. The plan worked very successfully with practically all the water being drained out of the jasper in the first stope opening and drained to the level through a small raise and a drift connecting the south ends of the transfers which were driven down grade. As a result, all of the other workings in the area were quite dry. One large, successful stope was developed and mined out to the jasper 100' above the transfer sub and a second was being developed in December.

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7. UNDERGROUND: (Continued)

b. Development:

c. Stoping:
(Continued)

5th Level (-580'): (Continued)

Operations in the second block, north of the transfer, developed ore to a much greater height from a transfer drift driven north to the dike. In the northwest portion of the deposit, near the intersection of the dike and the fault, the jasper was found at elevation -400', or 85' above the -485' sub-level. A second transfer drift was driven through the dike to the other working territory through 200' of high grade Standard ore. In the east end of the second block the jasper was found at a much lower elevation due to the pitch, and development was confined to a transfer drift east of #3 Cross-cut on the -550' sub-level from which a small stope was developed to the north to the jasper at a height of 50' above the transfer.

A considerable amount of exploratory drifting was done in the interbedded ore which lies under the larger deposits. Most of this work was done on the -535' sub-level on both sides of the fault. All of the ore was of excellent grade in the deposit which varies in thickness from 40' to 100'. Mining will be postponed until operations have been completed in the upper horizon above the slates.

The area north of #5 dike and east of the fault was developed quite extensively on the -475' sub-level where the main transfer system was put in from Raises #5201 and #510. A long east-west transfer was driven along the footwall and a number of raises were put up to the -435' and -410' sub-levels where mining will be started early next year. Development indicates a large tonnage, only part of which will be Standard grade. Above the -475' sub-level the sulphur is very spotty and in general too high for the Standard product. As in the deposit south of the dike, the ore rises to the northwest along the fault and pitches downward to the southeast under the jasper along the dike.

The same general mining methods were followed, with sub-level stoping immediately under the capping and sub-level caving under the stopes after they are filled with caved rock. The ore varies widely in structure and consistency, a condition requiring constant supervision. Excellent progress was made in adapting sub-caving to new conditions and considerable experimenting was done with long hole radial drilling in the stopes. This latter method shows great promise for both increased safety and efficiency.

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7. UNDERGROUND: (Continued)

- b. Development:
- c. Stoping:
(Continued)

6th Level (-740')

The driving of the main footwall drift to the southeast was continued beyond the turnout for #2 Cross-cut where it was turned to the north east parallel to the strike and continued to a point 100' beyond #3 Cross-cut by the end of the year. Cross-cuts #1 and #2 were continued only far enough beyond the curves to permit switching and drilling. Cross-cut #3 was driven to the southeast a distance of 300' through 125' of interbedded ore, beyond which the interbedded slates and a small amount of ore in the fault zone were encountered. By the end of the year the heading had reentered the slates on the west side of the fault. The present schedule calls for the development of a number of working places in several cross-cuts and the completion of the main pumping plant, after which the main drift will be driven as rapidly as possible into Section One for a connection with the new shaft approximately 8,000' east of the Mather Shaft.

A considerable amount of work was done in the new pumping plant immediately north of the shaft and east of the plat. The drift connecting the north ends of the twin sumps was completed at a distance of 140' from the main drift. The first sump was completed at a distance of 210' from the connecting drift and stripped to the final 12' x 12' cross-section for a distance of 125'. The work will be continued into next year and completed as soon as possible.

Raise #6101, the first of a number of ventilation connections, was started late in the year and almost completed to the 5th Level. The raise, which is double compartment and cribbed, will greatly improve the ventilation on both levels.

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7. UNDERGROUND:
(Continued)

d. Timbering:

The following table is a record of all timber and timbering supplies used during the year on all operations. The decrease in the use of structural steel for main level timbering was due to difficulty in obtaining delivery. As soon as adequate supplies can be obtained, large quantities of steel will be used to replace timber in the main level rock drifts and the plats.

Statement of Timber Used - All Operations

	<u>LINEAL FEET</u>	<u>AVG. PRICE PER FOOT</u>	<u>AMOUNT 1946</u>	<u>AMOUNT 1945</u>
5' 4" Cribbing	138,220	.06619	\$ 9,148.57	\$ 6,390.91
8" - 10" Stulls	36,688	.09451	3,467.26	2,018.56
10"- 12" Stulls	35,211	.14074	4,955.52	4,195.93
12"- 14" Stulls	23,866	.19773	4,719.06	4,667.61
16' & 18' Mining Timbers	<u>2,948</u>	<u>.16769</u>	<u>494.35</u>	<u>131.20</u>
Total	236,933	.09617	\$22,784.76	\$17,404.21
Total 1945	136,002	.12797		
		<u>PER 100'</u>		
7' Lagging	1,094,581	1.4416	\$15,779.41	\$12,437.85
9½" Poles	<u>483,882</u>	<u>2.3912</u>	<u>11,570.37</u>	<u>6,907.06</u>
Total	1,578,463	1.7327	\$27,349.78	\$19,344.91
Total 1945	1,136,856	1.7016		
		<u>PER UNIT</u>		
4" x 4" x 9' H-Columns 10 lbs. per foot	102 Pcs.	2.64	\$269.28	
4" x 4" x 9' H-Columns 13 lbs. per foot	51 Pcs.	3.01	153.49	
Total	<u>153 Pcs.</u>		<u>\$422.77</u>	
Total 1945				\$1,627.42
 GRAND TOTAL TIMBER & TIMBERING SUPPLIES			 \$50,557.31	 \$38,376.54

The following is a table of timbering supplies used in all operations charged to the operating account "Timbering", including stoping, development in ore and rock, and miscellaneous timber repairing. The decrease in the cost per ton reflects the use of smaller sizes in actual mining operations and was accomplished in spite of general increases in price.

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7. UNDERGROUND:
(Continued)

d. Timbering: (Continued)

Statement of Timber Used Under Operating Account "Timbering":

	<u>LINEAL FEET</u>	<u>AVG. PRICE PER FOOT</u>	<u>AMOUNT 1946</u>	<u>AMOUNT 1945</u>
5' 4" Cribbing	130,220	.06672	\$ 8,688.17	\$ 6,309.24
8" - 10" Stulls	36,427	.09453	3,443.60	1,480.32
10" - 12" Stulls	30,533	.14089	4,301.88	3,706.47
12" - 14" Stulls	12,507	.19567	2,447.35	3,811.34
16' & 18" Mining Timbers	1,486	.16484	244.95	13.12
Total	<u>211,173</u>	<u>.09057</u>	<u>\$19,125.95</u>	
Total 1945	124,416	.12314		\$15,320.49
		<u>PER 100'</u>		
7' Lagging	785,188	1.43717	\$11,284.47	\$ 9,447.61
9½' Poles	374,088	2.38669	8,928.31	5,191.71
Total	<u>1,159,276</u>	<u>1.74356</u>	<u>\$20,212.78</u>	
Total 1945	861,242	1.6998		\$14,639.32
GRAND TOTAL			\$39,338.73	\$29,959.81
Product for Year			339,433	203,091
Ft. Timber per Ton of Ore			.6221	.6126
Ft. Lagging per Ton of Ore			2.3132	3.1693
Ft. Poles Per Ton of Ore			1.1021	1.0713
Ft. Lagging per Ft. of Timber			3.7182	5.1735
Cost per Ton for Timber			.0563	.0754
Cost per Ton for Lagging			.0332	.0465
Cost per Ton for Poles			.0263	.0256
Cost per Ton for Timber, Lagging & Poles			.1158	.1475

Main level drifting on the 5th and 6th Levels totaled 4,666', all of which was timbered except for a distance of 306' which was supported with steel sets. The following table is a record of the timbering supplies used in this work, which was done under E&A's NM-26 and NM-27.

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7. UNDERGROUND:
(Continued)

d. Timbering: (Continued)

Amount and Cost of Timber Used in 4,666' of Main Level
Timbered Rock Drift, Including 306' Supported with Steel:

	<u>LINEAL</u> <u>FEET</u>	<u>AMOUNT</u>	<u>AMOUNT PER FT.</u> <u>TBRD. DRIFT</u>	<u>LINEAL FT. PER</u> <u>FOOT OF DRIFT</u>
8" -10" Stulls	261	\$ 23.66	.006	.06
10" -12" Stulls	4,678	653.64	.150	1.07
12" -14" Stulls	11,359	2,271.71	.521	2.61
16' & 18' Mining Timbers	<u>1,462</u>	<u>249.40</u>	<u>.057</u>	<u>.34</u>
Total	17,760	\$ 3,198.41	.734	4.08
7' Lagging	288,393	\$ 4,181.20	.896	61.81
9½' Tam. Poles	<u>109,794</u>	<u>2,642.06</u>	<u>.567</u>	<u>23.53</u>
Total	398,187	\$ 6,823.26	1.463	85.34
4" x 4" x 9' H-Columns 10 lbs. per ft.-2.64 ea.	102 Pcs.	269.28	.880	3.00
4" x 4" x 9' H-Columns 13 lbs. per ft.-3.01 ea.	<u>51 Pcs.</u>	<u>153.49</u>	<u>.502</u>	<u>1.50</u>
Total	153 Pcs.	422.77	1.382	4.50
TOTAL INC. STEEL		\$10,444.44	2.238	

The average cost per foot of \$2.24 including steel compares with \$2.93 last year. This decrease is due to the fact that in general the ground was not as heavy, which permitted putting the sets slightly farther apart. The cost per foot for the steel sets plus lagging and poles was \$2.85 per foot, the increased cost being easily offset by the fact that the steel is permanent.

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7. UNDERGROUND:
(Continued)

e. Drifting and Raising:

The following table shows all of the miscellaneous drifting and raising during the year including: Main levels, sub-levels, mining drifts, and the work done in the new 6th Level pumping plant and the east timber tunnel.

	<u>Drifting</u>		<u>Raising</u>		<u>Total</u>
	<u>Ore</u>	<u>Rock</u>	<u>Ore</u>	<u>Rock</u>	
Large Size	9,536'*	5,992'**	388'±	875'±	16,791'
Small Size	2,166'	165'	4,625'±±	101'±±	7,057'
	<u>11,702'</u>	<u>6,157'</u>	<u>5,013'</u>	<u>976'</u>	<u>23,848'</u>

* Timbered	Stripping and Timbering..	<u>410'</u>
**5,077' Timbered	Grand Total.....	<u>24,258'</u>
± Double Cribbed	Grand Total Last Year....	<u>20,447'</u>
±± 2,520' and 56' Single Cribbed		

Main level drifting and Cross-cutting was confined to the 5th and 6th levels. Several short distances which were driven without timber were later stripped and timbered or supported with steel, with the result that all drifting on both levels was timbered.

	<u>Timbered Ore Drift</u>	<u>Timbered Rock Drift</u>	<u>Total</u>
NM-26 5th Level	85'	2,561'	2,646'
NM-27 6th Level	<u>153'</u>	<u>2,105'</u>	<u>2,258'</u>
Total	238'	4,666'	4,904'
Total 1945	1,943'	2,914'	4,857'

Other capital account work is listed below:

NM-27 "Ventilation Raising" - 133' of double compartment cribbed raising from the 6th to 5th Levels.

NM-29 "East Timber Tunnel" - 278' of large untimbered rock drift (10' x 14').

NM-39 "6th Level Pumping Plant" - 426' of large untimbered rock drift, 146' of which was stripped to 12' x 12'.

All of the work shown in the main table, with the exception of the capital account work, was charged to operating under "Stoping", "Development in Ore" and "Development in Rock".

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7. UNDERGROUND:
(Continued)

f. Explosives, Drilling and Blasting:

The prices of all explosives and other blasting supplies were increased during the year, particularly on the extra gelatin powders. The use of Hercomite #2, (a bulk powder with more cartridges per box) in a large number of operations, partially offset the higher prices. The following table is a record of all explosives and supplies used on all operations during the year.

	<u>Quantity</u>	<u>Average Price</u>	<u>Amount 1946</u>	<u>Amount 1945</u>
60% Gelatin Extra	69,535#	12.678 CWT	\$ 8,815.46	\$ 5,916.75
80% Gelatin Extra	3,500#	16.429 CWT	575.00	5,574.24
Gelamite #1	38,363#	11.643 CWT	4,466.75	12,338.81
Hercomite #2	<u>159,616#</u>	<u>12.56 CWT</u>	<u>20,047.58</u>	<u>-</u>
Total Powder	271,014#	12.51 CWT	\$33,904.79	
Total Powder 1945	198,560#	12.00		\$23,829.80
Blasting Fuse	560,270'	5.562 M	\$ 3,116.35	\$ 2,333.27
No. 6 Blasting Caps	73,331	1.30 C	953.31	732.53
No. 14 Lead Wire	34,750'	20.469 M	711.29	535.50
Electric Blasting Caps	38,478	13.627 C	5,243.31	3,349.74
7" Fuse Lighter	20,000	6.75 M	135.01	50.64
Paper Shells	16,450	6.00 M	98.70	76.50
Master Fuse Shells	500	19.86 M	9.93	59.64
No. 20 Conn. Wire	1#	55.00 C	.55	.00
#1 Powder Bags	10	1.40 ea.	14.00	25.20
#2 Powder Bags	<u>55</u>	<u>3.45 ea.</u>	<u>189.75</u>	<u>96.35</u>
Total Fuse, Caps, Wire, Etc.....			\$10,472.20	\$ 7,259.37
GRAND TOTAL EXPLOSIVES & BLASTING SUPPLIES.....			\$44,376.99	\$31,089.17

The increase in the price of blasting supplies was more than offset by the fact that most of the ore produced came from actual mining operations rather than from development work as in previous years. Of the total production, only 10,000 tons came from main level drifting and cribbed ore raising, the balance being produced in miscellaneous sub-level work and actual mining operations. Both mining methods, sub-level stoping and sub-level caving, require a minimum of explosives, once the sub-level development work is completed. The new Hercomite powder was in use almost exclusively by the end of the year.

The cost of explosives charged to "Development in Rock" was \$2,500.12 for the year.

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7. UNDERGROUND:
(Continued)

f. Explosives, Drilling and Blasting (Continued):

Explosives Used in Breaking 339,433 Tons of Ore in
Stoping and Development In Ore.

	<u>Quantity</u>	<u>Average</u> <u>Price</u>	<u>Amount</u> <u>1946</u>	<u>Amount</u> <u>1945</u>
60% Gelatin	3,223#	13.744 C	\$ 443.00	\$ 2,777.83
80% Gelatin	-	-	-	320.04
Gelamite #1	34,092#	11.500 C	3,920.59	12,310.75
Hercomite #2	<u>113,108#</u>	12.496 C	<u>14,134.49</u>	-
Total Powder	<u>150,423#</u>		<u>\$18,498.08</u>	
Total Powder 1945	133,491#			\$15,408.62
Blasting Fuse	509,456'	5.574 M	\$ 2,839.86	\$ 2,289.11
No.6 Blasting Caps	66,862	1.3011C	869.95	718.92
No.14 Lead Wire	1,750'	20.605 M	36.06	139.50
Electric Blasting Caps	2,586	13.674 C	353.63	887.45
7" Fuse Lighters	20,000	6.750 M	135.01	50.64
Paper Shells	16,450	6.000 M	98.70	76.50
Master Fuse Shells	500	19.860 M	9.93	59.64
#1 Powder Bags	10	1.40 Ea.	14.00	23.80
#2 Powder Bags	42	3.45 Ea.	<u>144.90</u>	<u>75.65</u>
Total Caps, Wire, Fuse, Etc.....			\$ 4,502.04	\$ 4,321.21
GRAND TOTAL EXPLOSIVES & BLASTING SUPPLIES.....			\$23,000.12	\$19,729.83
Product.....			<u>1946</u> 339,433	<u>1945</u> 203,091
Pounds of Powder per Ton of Ore			.443	.657
Tons of Ore per lb. of Powder			2.256	1.521
Cost per Ton for Powder			.054	.076
Cost per Ton for Fuse, Caps, etc.			.013	.021
Cost per Ton for All Explosives			.067	.097

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7. UNDERGROUND:
(Continued)

f. Explosives, Drilling and Blasting: (Continued)

Explosives Used in Driving 4,666' of Main Level Timbered Drift - (5th and 6th Levels)

	<u>Quantity</u>	<u>Amount</u>	<u>Pounds of Powder Per Foot of Drift</u>	<u>Cost Per Foot</u>
60% Gelatin Powder	55,231#	\$ 6,957.68		
Gelamite #1	2,320#	313.20		
Hercomite #2	<u>29,490#</u>	<u>3,763.51</u>		
Total Powder	87,041#	\$11,034.39	18.65	\$2.36
Misc. Blasting Supplies.....		<u>4,392.59</u>	-	.94
Grand Total.....		<u>\$15,426.98</u>	18.65	\$3.30
Grand Total 1945 - 2,914'...			15.46	\$2.69

The increase in the amount of powder per foot of drift is due to the fact that the rock, particularly on the 6th Level, was much harder. The increase in cost per foot is due to the harder material and to general price increases; which were partially offset by the use of the Hercomite powder.

g. Loading and Trammig:

The three Conway Model 125 electric loaders worked with complete satisfaction; although the three shift, 6 day schedule on the 5th and 6th Levels required constant maintenance work. The two older machines were overhauled and the third will be as soon as it can be spared. The new design is a great improvement; and very little operating time was lost due to mechanical failures.

With a few minor improvements, the "Lake Shore Lohed" 100 cu.ft. tram cars worked perfectly in both ore and rock. An order was placed for 24 more for delivery early next year, to meet the demands of the expanding operation. The ten 90 cu.ft. "Cards" are now used exclusively for main level drifting and the ten old "Lake Shores" and ten "Pressed Steels" have now been enlarged to 100 cu.ft. and were in use throughout the year on the 2nd Level.

The shift in production from the 2nd to the 3rd and 5th Levels made it necessary to transfer two battery locomotives from the 2nd, leaving three on the upper level, one on the 3rd and two on the 5th. The three trolley locomotives were used by the two drifting crews and the crew working on the 6th Level pumping plant. An order for three more battery machines was placed for delivery as early in 1947 as possible. All three are for underground use but it is planned to transfer one of the older machines to surface for use in the timber tunnels.

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7. UNDERGROUND:
(Continued)

h. Ventilation:

The one addition to the main ventilation system was a permanent raise between the 6th and 5th Levels, the first of several which will be needed. The rock was so unstable that cribbing was necessary throughout the entire distance. The same general system was continued with the cage compartment downcast to the 3rd Level where the main fan is located. Distribution to the 2nd, 5th and 6th Levels and to local mining areas was controlled by doors as needed. The volume during the year varied from 30,000 to 40,000 C.F.M. depending on the number and size of the openings and the need for ventilating certain areas. A new fan with adjustable speed and volume up to 100,000 C.F.M. will be ordered early in the year. Installation will be on the 3rd Level; and a by-pass drift and an air lock will be necessary with the increased pressure. A heating plant on surface will also be necessary to avoid freezing in the shaft during cold weather. Plans for the plant are being studied and a proposal will be submitted as soon as a decision is reached.

i. Pumping:

Pumping from the 960' Level which drains the old Cleveland Hematite workings was fairly constant with a low of 41 G.P.M. in August, a high of 80 G.P.M. during the spring break-up in April and an average for the year of 62. This was during a year when the precipitation was considerably below normal. The improvement in the working places above the 2nd Level continued to the point where there was little excess water in any of the mining areas.

The water from the rest of the mine, which was handled by the main pumping plant on the 3rd Level, continued to decrease until November and December when a sharp increase was noted. The decrease was from 200 G.P.M. in January to 163 in September and 170 in October, after which the volume increased to an average of 245 in December and was still rising. The increase was all coming from the newly opened workings above the 5th Level south of #5 dike. Work on the new plant on the 6th Level was carried on during the latter months of the year in anticipation of even larger flows of water as new mining areas are opened. The main pumps and motors were delivered late in the year but the suction pumps and motors had not been received although all of the equipment has been on order since November 1945. As soon as the new pumps are running, the present practice of relaying the water to the 3rd Level from the 5th and 6th can be discontinued.

The pumping schedule during the year varied according to the volume and was increased when a resumption of mining operations on the 3rd Level made it impossible to continue the practice of using the main drift as an auxiliary sump.

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8. COST OF OPERATING: (Continued)b. Detailed Cost Comparison: (Operating)

	<u>1 9 4 6</u>		<u>1 9 4 5</u>	
	<u>Amount</u>	<u>Per Ton</u>	<u>Amount</u>	<u>Per Ton</u>
Exploring in Mine	5,962.06	.018	1,895.78	.009
Development in Rock	20,322.74	.060	16,061.22	.079
Development in Ore	20,331.33	.060	64,488.65	.317
Stoping	224,364.37	.661	198,853.15	.979
Timbering	132,865.50	.391	46,692.47	.230
Tramming	81,653.69	.241	24,464.22	.120
Ventilation	4,265.84	.013	-	-
Pumping	13,739.80	.040	20,846.12	.103
Compressors & Air Pipes	18,029.80	.053	10,497.66	.052
Underground Superintendence	19,660.41	.058	13,672.32	.067
Maint. Comp. & Power Drills	65.38	.000	731.97	.004
Scrapers & Mechanical Loaders	25,966.05	.076	-	-
Electric Tram Equipment	17,533.29	.052	-	-
Pumping Machinery	3,889.30	.011	2,399.00	.012
Total Undg. Costs	<u>588,649.56</u>	<u>1.734</u>	<u>400,602.56</u>	<u>1.972</u>
Hoisting	30,768.49	.090	34,280.39	.169
Stocking Ore	6,910.01	.020	20,403.07	.101
Dry House	16,806.55	.050	13,301.49	.065
General Surface Expense	13,436.96	.039	7,343.57	.036
Maint. Hoisting Equipment	16,887.59	.050	7,403.77	.037
Shaft	1,869.81	.006	-	-
Top Tram Equipment	3,023.90	.009	1,679.27	.008
Docks, Trestles & Pockets	20,310.82	.060	-	-
Mine Buildings	4,104.87	.012	4,466.77	.022
Total Surface Costs	<u>114,119.00</u>	<u>.336</u>	<u>88,878.33</u>	<u>.438</u>
Mining Engineering	8,549.77	.025	5,426.18	.027
Mechanical & Elect. Engrg.	1,723.82	.005	1,890.95	.009
Analysis & Grading	19,416.84	.057	19,231.06	.095
Safety Department	1,424.95	.004	-	-
Telephones & Safety Devices	2,583.74	.008	-	-
Local & General Welfare	2,465.99	.007	-	-
Special Exp. Pensions & Allow.	4,658.42	.014	606.62	.003
Ishpeming Office	14,480.87	.043	18,639.98	.092
Mine Office	26,682.05	.079	23,430.11	.115
Insurance	3,455.26	.010	3,741.73	.018
Personal Injury	9,109.80	.027	7,168.60	.035
Social Security Taxes	26,557.59	.077	7,504.44	.037
Employees Vacation Pay	19,256.53	.057	6,063.43	.030
Prop'n. of Retroactive Payrolls Applicable to 1945 Operations	-	-	11,098.34	.055
Group Annuity	312.71	.001	-	-
Total Gen. Mine Expenses	<u>140,678.34</u>	<u>.414</u>	<u>104,801.44</u>	<u>.516</u>
 COST OF PRODUCTION	 843,446.90	 2.484	 594,282.33	 2.926
 TAXES	 94,130.95	 .277	 93,191.86	 .459

MATHER MINE
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8. COST OF OPERATING (Continued)

<u>Charges Distributed By Mine Office:(Operating)</u>	<u>1 9 4 6</u>		<u>1 9 4 5</u>	
	<u>Amount</u>	<u>Per Ton</u>	<u>Amount</u>	<u>Per Ton</u>
General & Electrical Supplies	\$ 36,895.54	.109		
Iron and Steel	10,934.83	.032		
Oil and Grease	2,304.22	.007		
Machinery Supplies	23,525.49	.069		
Explosives	25,476.55	.075		
Lumber and Timber	46,117.31	.136		
Fuel	4,553.56	.013		
Electric Power	56,585.34	.167		
Other Items of Expense	9,613.35	.029		
Rental	399.80	.001		
Sales Tax	138.51	.000		
Total	\$216,544.50	.639		

Not Available

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8. COST OF OPERATING: (Continued)

b. Detailed Cost: (Idle Expense Due to Strike)

	1946 <u>Amount</u>
Exploring in Mine	741.91
Development in Ore	143.21
Stopping	2,492.00
Timbering	5,862.96
Tramming	436.10
Ventilation	267.49
Pumping	5,778.06
Compressors & Air Pipes	2,052.34
Underground Superintendence	6,205.67
Scrapers & Mechanical Loaders	721.89
Electric Tram Equipment	528.22
Pumping Machinery	988.26
Total Undg. Costs	26,218.11
Hoisting	7,058.79
Stocking Ore	403.42
Dry House	5,054.64
General Surface Expense	5,000.82
Maint. Hoisting Equipment	1,909.66
Shaft	292.81
Top Tram Equipment	146.00
Docks, Trestles & Pockets	132.88
Mine Buildings	294.57
Total Surface Costs	20,293.59
Mining Engineering	3,146.15
Mech. & Electrical Engineering	614.20
Analysis and Grading	2,642.66
Safety Department	378.00
Telephones & Safety Devices	90.25
Local & General Welfare	697.00
Special Exp., Pension & Allowances	1,394.82
Ishpeming Office	3,660.00
Mine Office	7,890.28
Insurance	1,109.24
Personal Injury	2,071.16
Social Security Taxes	1,401.19
Employees Vacation Pay	2,843.00
Group Annuity	223.92
Total General Mine Expenses	28,161.87
TOTAL IDLE EXPENSE	74,673.57

MATHER MINE
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8. COST OF OPERATING (Continued)

<u>Charges Distributed by Mine Office: (Idle)</u>	<u>1946</u> <u>Amount</u>
General Supplies	\$ 1,000.61
Iron and Steel	238.80
Oil and Grease	341.07
Machinery Supplies	767.35
Explosives	205.59
Lumber and Timber	506.74
Fuel	1,331.15
Electric Power	10,508.10
Sundries	2,418.03
Other Mines and Accounts	<u>2,268.48</u>
Total	\$19,585.92

MATHER MINE
ANNUAL REPORT
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8. COST OF OPENING, EQUIPPING,
DEVELOPING AND OPERATING:

a. Comparative Mining Costs:

The decrease of \$.612 per ton in the "Total Cost at Mine" was due entirely to the large increase in volume and was attained in spite of the substantial increase in wages. Idle expense of \$74,673.57 was incurred during the strike which lasted almost four months. This amount is not included in the following statement.

	<u>1946</u>	<u>1945</u>
Product - Tons	339,433	203,091
Underground Costs	1.734	1.972
Surface Costs	.336	.438
General Mine Expense	.414	.516
Cost of Production	<u>2.484</u>	<u>2.926</u>
Depreciation	.200	.216
Taxes	.277	.459
Loading and Shipping	.062	.034
Total Cost at Mine	<u>3.023</u>	<u>3.635</u>
Budget - Estimated Cost per Ton	3.149	
No. of Shifts and Hours	3 1-8 hr. 215 2-8 hr.	7 1-8 hr. 292 2-8 hr. 2 3-8 hr.
Total 8 hr. Operating Shifts	<u>433</u>	<u>597</u>
Number of Operating Days	216½ 2-8 hr.	298½ 2-8 hr.
Average Daily Product	1,568	680

Proportion of Labor and Supplies

<u>Labor</u>			<u>Supplies</u>			<u>Total Cost at Mine</u>		
<u>Amount</u>	<u>Per Ton</u>	<u>Per Cent</u>	<u>Amount</u>	<u>Per Ton</u>	<u>Per Cent</u>	<u>Amount</u>	<u>Per Ton</u>	<u>Per Cent</u>
\$584,662.72	1.723	57%	\$441,651.72	1.301	43%	\$1,026,314.44	3.023	100%

MATHER MINE
ANNUAL REPORT
YEAR 1946

8. COST OF OPENING,
EQUIPPING, &
DEVELOPING

Capital account expenditures for the year were \$351,388.89, which brought the total for the property to \$3,999,715.73. This figure does not include an amount of \$318,223.11 previously charged to Negaunee Mine Company "Idle Expense". The addition of this amount brings the grand total to date to \$4,317,938.84 after credit for ore produced during development. "General Expense" and "Maintenance" for the past two years have been charged into "Operating".

Approximately one-half of the capital expenditure for the year (\$172,115.49) was for main level development on the 5th and 6th Levels, and included only the work in rock. Drifting and Cross-cutting in ore was charged to "Operating". A substantial amount (\$84,047.35) was spent for mining and haulage equipment and approximately \$40,000.00 was spent on the new 6th Level pumping plant. On surface, expenditures were comparatively small and included \$15,000.00 for extensions to the stocking trestles; \$15,000.00 for timber tunnel and yards; and \$5,000.00 on the permanent buildings and equipment.

The following table is a summary of capital expense to the end of the year and the 1946 expenditures.

8. COST OF OPENING, EQUIPPING, AND DEVELOPING:

		<u>TOTAL EXPENDITURES TO DEC. 31, 1946</u>					
	<u>E&A</u>	<u>TOTAL</u>	<u>GROSS</u>	<u>CREDITS A/C</u>	<u>NET</u>	<u>UNEXPENDED</u>	<u>1946</u>
	<u>REFERENCE</u>	<u>AUTHORIZED</u>	<u>EXPENDITURES</u>	<u>ORE MINED IN</u>	<u>EXPENDITURES</u>	<u>BALANCE</u>	<u>EXPENDITURES</u>
				<u>DEVELOPMENT</u>			
1. BUILDINGS AND EQUIPMENT:							
a. Main Building.....	(10-10&19 10-10&19A)	280,000.00	279,990.27	-	279,990.27	9.73	222.25
b. Change House and Shop Equipment.....	10-26	60,000.00	57,884.03	-	57,884.03	2,115.97	880.94
c. Initial Shop Equipment....	(10-4 10-4A)	5,732.73	5,732.73	-	5,732.73	-	-
d. One 35 Ton Overhead Crane.	(10-9 10-9A)	8,894.94	8,894.94	-	8,894.94	-	-
e. Temporary Equipment.....	10-18	15,000.00	14,079.62	-	14,079.62	920.38	-
f. Erecting & Equipping Storage Building.....	31	20,900.00	20,969.11	-	20,969.11	69.11	3,747.87
g. Compressor Plant.....	(10-23 10-23A)	73,000.00	71,685.20	-	71,685.20	1,314.80	59.07
h. Hot Milling Equipment.....	43	2,871.20	-	-	-	2,871.20	-
TOTAL.....		466,398.87	459,235.90	-	459,235.90	7,162.97	4,910.13
2. SURFACE:							
a. Equipment:							
1. Temporary Surface Plant	10-3	31,130.00	26,506.28	-	26,506.28	4,623.72	-
2. Truck and Tractor.....	10-1	18,575.00	18,289.42	-	18,289.42	285.58	-
3. Electric Shovel.....	18	85,000.00	81,996.18	-	81,996.18	3,003.82	-
4. Top Tram Equipment....	(10-24 10-24A)	46,000.00	43,375.13	-	43,375.13	2,624.87	192.00
5. Timber Tunnel, Tracks Pumphouse and Sump...	(10-20 10-20A)	58,000.00	57,867.78	-	57,867.78	132.22	-
6. Timber Tunnel and Yards	29	74,800.00	23,534.86	-	23,534.86	51,265.14	14,620.84
7. Mechanical Additions - Headframe.....	32	27,500.00	27,500.00	-	27,500.00	-	1,885.01
Total.....		341,005.00	279,069.65	-	279,069.65	61,935.35	16,697.85
b. General:							
1. Diamond Drilling.....	9	81,000.00	80,965.78	-	80,965.78	34.22	874.06
2. Moving Two Houses.....	10-2	3,458.00	3,458.00	-	3,458.00	-	-
3. Drainage Well.....	10-11	1,896.00	1,896.00	-	1,896.00	-	-
4. Road Bldg., Paving Parking Lot, Etc.....	25	23,760.00	17,146.36	-	17,146.36	6,613.64	931.90
Total.....		110,114.00	103,466.14	-	103,466.14	6,647.86	57.84
TOTAL SURFACE.....		451,119.00	382,535.79	-	382,535.79	68,583.21	16,640.01
3. SHAFT, HEADFRAME AND TRESTLE:							
a. Sinking in Sand.....	(10-15 10-15A)	16,302.44	16,302.44	-	16,302.44	-	-
b. Sinking in Rock.....	(10-16 10-16A)	440,000.00	435,677.44	2,559.15	433,118.29	6,881.71	-
c. Shaft Sets.....	(10-5 10-5A)	160,975.45	159,754.21	-	159,754.21	1,221.24	9,129.96
d. Headframe Foundation & Ore Trestle.....	(10-21 10-21A)	78,000.00	77,417.73	-	77,417.73	582.27	-
e. Headframe and Trestle....	10-7/10-7A	186,028.83	186,028.83	-	186,028.83	-	-
f. Extensions to Perm. Stock. Trestles.....	36-42	59,352.48	49,503.28	-	49,503.28	9,849.20	14,953.66
g. Headframe & Power Ho. Eqpt.	10-22/10-22A	225,000.00	224,451.51	-	224,451.51	548.49	-
h. Elec. Equip. for Cage & Sk. Hsts.	10-8	221,783.00	221,783.00	-	221,783.00	-	-
i. 1 Cage Hoist & 1 Skip Hoist	10-6	143,000.00	143,000.00	-	143,000.00	-	-
j. Elevator for Headframe....	10-12/10-12A	4,853.00	4,853.00	-	4,853.00	-	-
k. Double Deck Cage Spare....	37	7,000.00	3,134.75	-	3,134.75	3,865.25	1,103.65
l. Pinion Brake for Cage Hoist	45	4,000.00	-	-	-	4,000.00	-
TOTAL SHAFT, HEADFRAME AND TRESTLE.....		1,546,295.20	1,521,906.19	2,559.15	1,519,347.04	26,948.16	25,187.27

8. COST OF OPENING, EQUIPPING AND DEVELOPING:

(Continued)

		TOTAL EXPENDITURES TO DEC. 31, 1946					
4. UNDERGROUND:	E&A REFERENCE	TOTAL AUTHORIZED	GROSS EXPENDITURES	CREDITS A/C ORE MINED IN DEVELOPMENT	NET EXPENDITURES	UNEXPENDED BALANCE	1946 EXPENDITURES
a. Plant:							
1. Pumping - 3rd Level.....	10-25/10-25A	55,000.00	53,738.88	-	53,738.88	1,261.12	1,007.68
2. Pumping plant - 6th Level	39	128,700.00	39,724.27	-	39,724.27	88,975.73	39,695.63
Total.....		183,700.00	93,463.15	-	93,463.15	90,236.85	40,703.31
b. Equipment:							
1. Mining Equipment.....	19	44,550.00	44,550.00	-	44,550.00	-	3,593.31
2. Mining Equipment.....	28	51,700.00	50,927.53	-	50,927.53	772.47	14,402.34
3. Mining Equipment.....	40	61,710.00	29,773.08	-	29,773.08	31,936.92	29,773.08
4. Mining Equipment.....	41	28,050.00	11,192.00	-	11,192.00	16,858.00	11,192.00
5. Haulage Equipment.....	10-29/10-29A	110,000.00	107,968.83	-	107,968.83	2,031.17	5,024.94
6. Haulage Equipment.....	23	90,420.00	82,275.25	-	82,272.25	8,144.75	8,518.96
7. Haulage Equipment.....	46	84,755.00	290.84	-	290.84	84,464.16	290.84
8. Underground Substations.	38	14,300.00	11,251.88	-	11,251.88	3,048.12	11,251.88
Total.....		485,485.00	338,229.41	-	338,229.41	147,255.59	84,047.35
c. Development:							
1. Main Level Development:							
Plats and Pockets.....	(10-28/10-28A 26-26A/27-27A)	220,000.00	216,551.25	-	216,551.25	3,448.75	63.22
Drifting.....	(10-27/24/26- 26A/27-27A/33)	1,137,871.20	821,723.93	80,404.67	741,319.26	396,551.94	172,115.49
Ventilation and 2nd Outlet.....	26-26A/27-27A	53,900.00	11,376.34	-	11,376.34	42,523.66	3,353.60
2. Development & Mining	(24/26-26A 27-27A/34)	203,728.80	194,487.12	49,921.83	144,565.29	59,163.51	-
3. Underground Exploration.	21	35,000.00	28,929.83	-	28,929.83	6,070.17	4,190.71
Total.....		1,650,500.00	1,273,068.47	130,326.50	1,142,741.97	507,758.03	179,723.02
d. Dewatering Hematite Workings	30	66,000.00	64,162.47	-	64,162.47	1,837.53	177.80
TOTAL UNDERGROUND.....		2,385,685.00	1,768,923.50	130,326.50	1,638,597.00	747,088.00	304,651.48
GRAND TOTAL BEFORE CONTINGENCIES...		4,849,498.07	4,132,601.38	132,885.65	3,999,715.73	849,782.34	351,388.89
Plus 10% for Contingencies.....		228,217.26	-	-	-	228,217.26	-
GRAND TOTAL INCLUDING CONTINGENCIES		5,077,715.33	4,132,601.38	132,885.65	3,999,715.73	1,077,999.60	351,388.89
General Expense.....	10-13	-	271,716.98	-	271,716.98	-	1946 Expense
Maintenance.....	10-14	-	37,050.73	-	37,050.73	-	taken up in "Cost
Building Roads & Landscaping.....	10-17	-	9,455.40	-	9,455.40	-	of Operating"
Total to Negaunee Mine Company							
Idle Expense.....		-	318,223.11	-	318,223.11	-	
GRAND TOTAL.....		5,077,715.33	4,450,824.49	132,885.65	4,317,938.84	1,077,999.60	351,388.89

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

Practically all of the main level rock drifts driven during the year on both the 5th and 6th Levels required support with either timber or steel sets. For a number of operating reasons, including the fact that structural steel is not available in sufficient quantity, it is better to use ordinary timber while driving the drifts and to later replace the timber with steel sets. This recurring expense will be taken into the operating cost sheet in the future.

Main level drifting in rock totaled 4,666' during the year, 2,561' on the 5th and 2,105' on the 6th. A small amount, originally driven without timber and later stripped and timbered, is included in the total as timbered drift; as is the small amount supported with steel sets. The increase in wages and supply costs had the effect of increasing the direct cost per foot; but the total cost is substantially lower than last year due to the fact that the operating cost sheet absorbed a greater proportion of the overhead distributive costs.

<u>Timbered</u>	<u>Actual</u>	<u>Timbering</u>	<u>Total</u>	<u>Distribu-</u>	<u>Grand</u>	<u>1945</u>
<u>Rock Drift</u>	<u>Per Foot</u>	<u>& Labor</u>	<u>Per Foot</u>	<u>tive</u>	<u>Total</u>	<u>Grand Total</u>
		<u>Per Foot</u>	<u>Per Foot</u>	<u>Charges</u>	<u>Per Foot</u>	<u>Per Foot - 2,089'</u>
				<u>Per Foot</u>	<u>Per Foot</u>	
4,666'	\$27.76	\$4.91	\$32.67	\$3.72	\$36.39	\$42.49

The above cost varied from \$38.53 per foot on the 6th Level where the rock is harder but still requires support, to \$34.63 on the 5th Level.

The only other capital account item on which a cost was kept was the ventilation raise from 6th to 5th under E&A NM-27. The cost on 133' of double compartment, cribbed rock raise was \$25.21 per foot as compared with 484' in 1945 at \$22.55.

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9. EXPLORATIONS
AND
FUTURE
EXPLORATIONS:

Diamond drilling in Section 2 was confined to five underground holes, #24 to #28 inclusive. D.D.H. #24 was drilled for long range, geological information and was charged to capital account under E&A NM-21. The others were drilled in advance of main level development and mining operations; and were taken up in the cost sheet under "Exploring in Mine".

D.D.H. #24 was drilled to a depth of 1,005' beyond the end of #7 Cross-cut in an effort to locate mineable reserves in the vicinity of Surface Hole #39. Several short runs of ore were encountered, but not enough to warrant further exploration. The large amount of high pressure water encountered was used for a time for drilling and the hole was later concreted in advance of mining operations above the 3rd Level.

Holes #25, #26 and #27 were drilled in an attempt to locate ore beyond the end of #4 Cross-cut on the 5th Level. No ore was found either above or below the level at this point.

Hole #28, drilled in advance of #5 Cross-cut, encountered the interbedded ore in the normal location and, in addition, disclosed a large ore body beyond #5 dike, under the jasper capping. This deposit will be developed as quickly as possible next year.

The drilling for the year, which totaled 2,080', is recorded in the following table.

MATHER MINE EXPLORATION
YEAR 1946

<u>NO.</u>	<u>LOCATION</u>	<u>DIRECTION</u>	<u>DIP</u>	<u>DATE</u>		<u>MATERIAL</u>	<u>FINISHED DEPTH</u>
				<u>STARTED</u>	<u>FINISHED</u>		
24	2nd Level (1600') #7 Cross-cut	S.34°04'E	0°	12/27/45	7/30/46	0 - 263' Soft Ore Jasper 263 - 270' Dike 270 - 400' Soft Ore Jasper 400 - 409' Dike 409 - 795' Soft Ore Jasper, Lean Ore 795 - 797' 1st Class Ore 797 - 863' Soft Ore Jasper, Lean Ore 863 - 874' 1st Class Ore 874 - 895' Lean Ore Jasper 895 - 917' Ore 917 - 1005' Lean Ore and Jasper	1,005'
25	5th Level (2050') #4 Cross-cut	S.0°31'E	+3°	1/22/46	6/15/46	0 - 49' Ferruginous Slate 49 - 63' Transition Slate and Jasper 63 - 74' Dike 74 - 104' Transition Slate and Jasper 104 - 416' Soft Ore Jasper, Lean Ore	416'
26	5th Level (2050') #4 Cross-cut	Due South	-29°	6/19/46	6/28/46	0 - 113' Ferruginous Slate	113'
27	5th Level (2050') #4 Cross-cut	S.0°46'E	+18°	7/1/46	7/25/46	0 - 25' Slate 25 - 60' Transition Slate and Jasper 60 - 65' Dike 65 - 270' Soft Ore Jasper	270'
28	5th Level (2050') #5 Cross-cut	S.0°14'W	+3°30'	11/29/46	-	0 - 10' Slate and Graywacke 10 - 40' Slate 40 - 48' Ferruginous Slate 48 - 78' Interbedded Ore 78 - 93' Slate 93 - 160' Mixed Slate and Jasper 160 - 177' Dike 177 - 225' Soft Ore Jasper 225 - 355' Ore	

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9. EXPLORATIONS
AND
FUTURE
EXPLORATIONS:
(Continued)

The following statement shows the cost of drilling 2,080', and includes both the charges to E&A NM-21 of \$4,190.71 for 926' and the cost sheet charge of \$3,681.38 for 1,154'. The E&A charge includes \$712.15 for concreting Hole #24.

	<u>1946</u> <u>Expenditures</u>	<u>Cost</u> <u>Per Foot</u>	<u>Cost Per</u> <u>Foot 1945</u>
<u>Equipment:</u>	-	-	-
 <u>Drilling Costs:</u>			
Labor.....	\$ 4,616.56	\$2.220	\$1.444
Miscellaneous Supplies & Diamond Drill Carbon.....	2,142.60	1.030	2.753
Diamond Drill Rental.....	-	-	.003
Total.....	<u>\$ 6,759.16</u>	<u>\$3.250</u>	<u>\$4.200</u>
 <u>Overhead Expense:</u>			
Analysis.....	\$ 258.55	\$.124	\$.168
Geological.....	387.63	.186	.216
D. D. Supt.....	398.46	.192	.025
Social Security.....	68.29	.033	.032
Total.....	<u>\$ 1,112.93</u>	<u>\$.535</u>	<u>\$.441</u>
 Grand Total.....	 \$ 7,872.09	 \$3.785	 \$4.641

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10. TAXES:

The Mather Mine (Section 2) and the Jackson (Section 1) valuations were unchanged from the previous year. A slight reduction in the rate in the City of Ishpeming reduced the tax slightly; but a substantial increase in the City of Negaunee rate had the effect of increasing the total tax by approximately \$1,000.00. As usual, the rate in Negaunee is much higher than in Ishpeming.

The Mather operation carried the taxes for both descriptions.

	<u>1946</u>			<u>1945</u>		
	<u>VALUATION</u>	<u>RATE</u>	<u>TAXES</u>	<u>VALUATION</u>	<u>RATE</u>	<u>TAXES</u>
Section 2, 47-27, except the N 600' of NE of NE and the Rights of Way						
Real	\$1,615,000		\$57,999.50	\$1,770,000		\$63,608.84
Personal	385,000		13,826.51	230,000		8,265.56
Total	<u>\$2,000,000</u>	<u>\$35.9130</u>	<u>\$71,826.01</u>	<u>\$2,000,000</u>	<u>\$35.9372</u>	<u>\$71,874.40</u>
Coll. Fee	-		-	-		-
Total	<u>\$2,000,000</u>	<u>\$35.9130</u>	<u>\$71,826.01</u>	<u>\$2,000,000</u>	<u>\$35.9372</u>	<u>\$71,874.40</u>
Mather Mine Pipe Line, parcel in Section 3, 47-27	\$ 350	\$35.9130	\$ 12.57	\$ 350	\$35.9372	\$ 12.57
Total Mather Mine (Sec.2, City of Ishpeming)	\$2,000,350	\$35.9130	\$71,838.58	\$2,000,350	\$35.9372	\$71,886.97
Jackson, Section 1, 47-27	\$ 500,000	\$44.1433	\$22,071.65	\$ 500,000	\$42.1879	\$21,093.95
Coll.Fee 1%	-	.4414	220.72	-	.4219	210.94
Total Section 1 (City of Negaunee)	\$ 500,000	\$44.5847	\$22,292.37	\$ 500,000	\$42.6098	\$21,304.89
GRAND TOTAL	\$2,500,350		\$94,130.95	\$2,500,350		\$93,191.86

	<u>1946</u>		<u>1945</u>	
	<u>Tons</u>	<u>Per Ton</u>	<u>Tons</u>	<u>Per Ton</u>
Taxes per Ton Produced	339,433	\$0.277	203,091	\$0.459
Taxes per Ton Shipped	317,351	\$0.297	168,205	\$0.554

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11. ACCIDENTS
AND
PERSONAL
INJURY:

There were 14 compensable injuries during the year which resulted in a loss of 640 days. Thirteen non-compensable injuries (1-7 days) added 27 days, for a total of 667. The frequency rate of 51.793 injuries per million man hours, and severity rate of 1.279 days lost per thousand man hours compare with the Company averages of 37.812 and 1.388, including open pits and the Power Company. In the underground operations the Mather was fourth in both frequency and severity, the averages being 49.490 and 1.330 respectively. The total hours worked were 521,338 as compared with 480,886 last year. The following is a brief summary of the compensable accidents.

<u>DATE</u>	<u>NAME</u>	<u>NATURE OF INJURY</u>
1/21/46	George E. Butler	Fracture of wing of ilium.
6/25/46	William J. Hooper	Fracture and contusion of left foot.
7/6/46	Angelo Moretti	Sprained right ankle, bruised left knee.
7/14/46	Adolph Honkala	Sprained right ankle.
7/20/46	Eino Maki	Contusions back and shoulders.
8/22/46	Frank Ayotte	Minor fracture of left foot.
8/24/46	Robert Delago	Fracture little toe left foot.
9/18/46	Beryl Turino	Fracture right foot.
9/24/46	Edwin C. Koski	Amputation terminal phalanx 2nd finger right hand.
9/26/46	Isaac Hankanen	Contusion right shoulder.
10/2/46	Waino Korpi	Lacerations upper and lower lips.
10/2/46	Charles Horst	Minor bruise left foot.
10/29/46	Reino Sippola	Amputation tips 4th and 5th fingers right hand.
11/29/46	Egidio Torreano	Infected puncture wound right hand.

12. NEW CONSTRUCTION
AND PROPOSED
NEW CONSTRUCTION:

The small amount of new construction included: The installation of the permanent stockpile tracks by the L. S. & I. Railroad; the concreting of the east portal of the east timber tunnel; the completion of the larry car repair shed and the erection of the sawmill building. The largest project was the placing of concrete and steel in the column footings for the extensions to the permanent stocking trestles. Four footings were completed to provide for two 125' spans on both the north and south trestles. It has now been decided to extend the north trestle an additional span of 125' which will require a fifth footing. Except for the completion of the east timber tunnel and both timber yards, and the erection of the trestle extensions, there is no new construction under consideration at the present time.

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13. EQUIPMENT AND
PROPOSED
EQUIPMENT:

A considerable amount of new equipment was purchased during the year, the bulk of which was for underground use. Additional purchases of mining and haulage equipment were necessary to keep pace with the enlarging operation. Due to the difficulty of obtaining delivery, especially on electrical equipment, orders were placed for drill machines, scraper hoists, cars and locomotives well in advance of actual need. By the end of the year, there was sufficient equipment for 25 contracts and additional scraper hoists for transferring and skip loading. In addition to two small trolley locomotives acquired from other mines, there were three 6-ton battery locomotives with extra batteries and charging equipment, twenty-four 100 cu. ft. granby type cars and ten scraper hoists on order at the end of the year. The two 500 G.P.M. Worthington horizontal pumps and motors for the new plant on the 6th Level were delivered before the end of the year, but the suction pumps and motors and a considerable amount of pipe and fittings had not yet been received.

The problem of additional compressor capacity was solved by the ordering of two slightly used Ingersoll-Rand P.R.E. compressors, identical in size and design to the two originals at the property. The machines are to be purchased as government war surplus at a considerable saving and will be delivered early in 1947.

14. MAINTENANCE
AND REPAIRS:

E&A NM-32, which was authorized several years ago for "Mechanical Changes and Additions" in the headframe, was exhausted early in the year. The work was continued and charged to "Maintenance:- Docks, Trestles and Pockets" in the operating cost sheet. Most of the expensive changes in the headframe proper were completed before shipping began in the spring, as well as the changes to the east half of the south railroad loading pocket. The new design worked so well that work was begun on the west half as soon as shipping was discontinued in the fall. Another addition, also charged to maintenance, was a large enclosure on the east side of the headframe adjacent to the two skip compartments. This enclosure is large enough to permit the mechanical crew to inspect and change the skips under cover and greatly increases the efficiency of all skip maintenance, particularly in the winter.

The other unusually large maintenance job was in the engine house where the installation of the water softening equipment was completed early in the year. The work of replacing the steel pipe in the system with copper was continued and practically completed by the end of the year. The cost of this work was charged to operating under "Maintenance: - Hoisting Equipment". All other maintenance work at the plant was of a routine nature.

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15. POWER:

	<u>CONSUMPTION</u> <u>K.W. HOURS</u>	<u>AVERAGE</u> <u>MAX. DEMAND</u>	<u>AVERAGE</u> <u>DEMAND FACTOR</u>	<u>COST OF</u> <u>CURRENT</u>	<u>AVERAGE PRICE</u> <u>PER K.W. HOUR</u>
1946 -	5,570,000	1,530 K.W.	48%	\$80,677.20	\$0.0144
1945 -	4,720,000	1,245 K.W.	43%	\$69,566.20	.0148
1944 -	3,893,000	965 K.W.	46%	56,121.80	.0144
1943 -	2,785,000	600 K.W.	48%	39,725.80	.0142
1942 -	1,510,830	325 K.W.	47%	23,448.14	.0155

In line with the increasing operation there was another sharp increase in total consumption and average maximum demand, both of which would have been much larger except for the strike. With the increase in production, the practice of running both hoists from the large M-G Set was discontinued and each machine was run from its own generator. This permitted hoisting at the maximum speeds of 2,400 feet per minute with the skips and at 2,000 with the cage. The change-over panel was installed early in the year and greatly simplifies the task of changing back and forth as necessary.

16. WATER SUPPLY:

	<u>CONSUMPTION</u>	<u>COST</u>	<u>COST PER</u> <u>THOUSAND GAL.</u>
1946 -	10,620,100	\$928.41*	\$.086**
1945 -	7,628,800	710.71	.093
1944 -	5,205,200	481.82	.092
1943 -	4,868,000	446.64	.092
1942 -	2,487,000	231.36	.093

* Includes \$14.00 for unmetered lawn sprinklers.

** Exclusive of unmetered lawn sprinklers.

Once again there was a large increase in consumption of water which is purchased from the City of Ishpeming. This is due to the increase in the number of men using the dry, since the water is not used underground.

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18. NATIONALITY
OF EMPLOYEES:

	<u>American</u> <u>Born</u>	<u>Per</u> <u>Cent</u>	<u>Foreign</u> <u>Born</u>	<u>Per</u> <u>Cent</u>	<u>Total</u>	<u>Per</u> <u>Cent</u>
American	43	12.3%	-	-	43	12.3%
English	37	10.6	10	2.9%	47	13.5
Finnish	91	26.0	18	5.1	109	31.1
Canadian	4	1.1	1	.3	5	1.4
Swedish	31	8.8	3	.9	34	9.7
Norwegian	6	1.7	1	.3	7	2.0
German	5	1.4	-	-	5	1.4
Irish	5	1.4	-	-	5	1.4
Danish	1	.3	-	-	1	.3
Italian	31	8.8	11	3.1	42	11.9
French	44	12.6	-	-	44	12.6
Manx	1	.3	-	-	1	.3
Dutch	2	.6	-	-	2	.6
Austrian	2	.6	1	.3	3	.9
Polish	2	.6	-	-	2	.6
Total	305	87.1%	45	12.9%	350	100.0%

MORRIS MINE
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1. GENERAL

Mine production was limited to a period of eight and one half months, the property being idle from February 8th to May 22nd due to a strike called by the CIO throughout the Lake Superior District. A wage increase of 18½¢ per hour was shortly followed by an OPA upward revision in the price of iron ore, but in the meantime production loss reduced the total for 1946 to the lowest figure since 1934. Shipments also were some 60,000 tons less than last year, and at a new low since 1934.

Several changes were made in supervisory personnel during the year. R. D. Satterley on June 15th was promoted to General Superintendent, replacing R. L. Wahl, resigned. E. W. Whitman was made Assistant Superintendent at the Morris following the transfer of F. A. Olson to the superintendency of the Greenwood Mine of Inland in January.

Development of new sub level stoping areas above the 9th Level in 1945 was reflected in increasing production following the strike in 1946. Mining method revision was carried still farther in gradually replacing top slicing by sub level caving in certain portions of the mine where conditions warranted. The ore grading problem was then made easier by lease revision to permit royalties on a sliding scale based on iron content of the ore mined. Thus a new "Morris Grade" was stocked at the end of the 1946 shipping season resulting from the mixing of the former Standard and Silicious grades in the underground pockets and in stockpile, and with royalties based on the average iron analysis.

Underground development, particularly above the 9th Level, again resulted in improving the ore reserve position over that of last year. Water control by means of surface deep well and underground pumping was continued, and surprisingly with reduced ore production, the cost per ton was slightly below that of last year.

2. PRODUCTION
SHIPMENTS &
INVENTORIES

a. Production

<u>Grade</u>	<u>Tons</u>	<u>Percent</u> <u>of Total</u>
Morris Standard	118,034	63.7
Morris Silicious	45,559	24.6
Morris (New Grade)	21,612	11.7
TOTAL	185,205	100.0
Total last year	238,855	

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2. PRODUCTION
SHIPMENTS &
INVENTORIES (Cont.)

The 1946 production came from fee and leased lands in the following proportions:

<u>Grade</u>	<u>Fee</u>	<u>Lease</u>	<u>Total</u>
Morris Standard	27,051	90,983	118,034
Morris Silicious	2,976	42,583	45,559
Morris (new grade)	<u>5,494</u>	<u>16,118</u>	<u>21,612</u>
TOTAL	35,521	149,684	185,205
Percent of Total	19.2	80.8	100.0

The percentage figures compare with 15.8% and 84.2% respectively last year. The maximum proportion of ore from the fee lands to date was 48.1% in 1936, and the minimum 11.4% in 1941. A summary of fee and lease total production since the Inland Steel Company acquired the Morris Mine lease starting with 1933, or over a fourteen year period, is listed below:

	<u>Tons</u>	<u>Percent</u>
Lease ore product 1933-1946	3,101,664	75.5%
Fee ore product 1933-1946	<u>1,004,240</u>	<u>24.5%</u>
Total 1933-1946	4,105,904	100.0%

b. Shipments

Shipment of ore from the Morris Mine reached a high of 442,199 tons in 1943, with decreases occurring in each of the last three years. The 1946 total was divided as follows:

<u>Grade</u>	<u>Pocket Tons</u>	<u>Stockpile Tons</u>	<u>Total Tons</u>
Morris Standard	88,310	53,847	142,157
Morris Silicious	<u>29,403</u>	<u>10,447</u>	<u>39,850</u>
Total	117,713	64,294	182,007

The above total tonnage comprised shipments of 34,514 tons fee and 147,493 tons lease ore.

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

<u>Year</u>	<u>Standard Ore</u>	<u>Silicious Ore</u>	<u>Total Tons</u>
1946	142,157	39,850	182,007
1945	175,688	69,480	245,168
1944	236,764	83,169	319,933
1943	316,805	125,394	442,199
1942	307,101	89,670	396,771

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2. PRODUCTION
SHIPMENTS &
INVENTORIES(Cont.)

A summary of shipments since the Inland Steel Company acquired the lease shows:

	<u>Tons</u>
Standard ore shipped 1933-1946	3,138,149
Silicious ore shipped 1933-1946	930,952
Total	4,068,671

c. Ore in Stock

The stockpile balance December 31st, consisted only of the new Morris grade, and compared with a total of 34,040 on the same date last year:

<u>Grade</u>	<u>Tons</u>
Morris	37,236

e. Production by Months

<u>Month</u>	<u>Days</u>	<u>Morris Standard</u>	<u>Morris Silicious</u>	<u>Morris</u>	<u>TOTAL Tons</u>	<u>Tons per Man Per Day</u>
January	24	15,676	2,468		18,144	4.70
February(1 - 8)	5½	3,420	1,372		4,792	5.78
March (idle)						
April "						
May (idle & repair)						
June	22½	9,007	5,475		14,482	3.98
July	24	15,231	6,117		21,348	5.20
August	24½	17,341	7,839		25,180	5.91
September	21½	18,030	5,413		23,443	6.54
October	25	25,805	6,705		32,510	7.39
November	21½	13,524	10,170		23,694	6.44
December	22	-	-	21,612	21,612	5.58
TOTAL	190½	118,034	45,559	21,612	185,205	5.72

The productive efficiency reached a low in June following the strike when considerable repair and clean up work was performed to ready the mine for the increased production which followed. Expanded sub level stoping operations contributed to the production of 32,510 tons in October, the highest monthly production rate achieved since December 1943. The improved tons per man in the last half of the year brought this average up to 5.72 in comparison to 4.80 in 1945 and 5.70 in 1944.

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2. PRODUCTION
SHIPMENTS &
INVENTORIES (Cont.)

The working schedule during 1946 was as follows:

2 shifts - $5\frac{1}{2}$ days per week - January 1st to February 8th.
Mine idle due to strike February 8th to May 23rd.
2 shifts - $5\frac{1}{2}$ days per week - May 23rd to December 31st.

The two shift, five and a half day schedule was put into effect Sept. 1st, 1945.

f. Delays

Although no tonnage loss was estimated, the main level repair and clean-up program early in June following the strike delayed production from certain areas in the mine until resumption of mining was possible under normal conditions. Before and after this period no production or hoisting delays were reported.

3. ANALYSIS

Shipments

The dried analyses of ores sampled and analyzed by the Inland Steel Company in 1946 were as follows:

<u>Grade</u>	<u>Tons</u>	<u>Iron</u>	<u>Phos.</u>	<u>Sil.</u>	<u>Mang.</u>	<u>Alum.</u>	<u>Moist</u>
Morris Standard	142,157	58.518	.084	8.93	.53	2.76	11.11
Morris Silicious	39,850	51,619	.068	18.92	.40	3.06	10.74

Natural Analysis of Ore in Stock Dec. 31, 1946

	<u>Tons</u>	<u>Iron</u>	<u>Phos.</u>	<u>Sil.</u>	<u>Mang.</u>	<u>Moist</u>
Morris (new grade)	37,236	48.80	.070	12.04	.47	11.70

Expected Natural Analyses of Ore Reserves

	<u>Tons</u>	<u>Iron</u>	<u>Phos.</u>	<u>Sil.</u>	<u>Mang.</u>	<u>Alum.</u>	<u>Sul.</u>	<u>Moist.</u>
Morris	3,940,721	50.65	.079	11.03	.43	2.60	.013	11.70
Morris Hi-Sulphur	184,129	52.17	.095	7.25	.40	2.27	.400	10.50

The ore reserve was changed to Morris grade from Morris Standard for report to the Tax Commission. This changed the expected silica from 7.92 to 11.03 without a corresponding increase in the tonnage which must be expected as a result of dilution. It may safely be stated that the reserve tonnage to be expected with an 11% silica content will more closely approximate 5 million

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3. ANALYSIS (Cont.)

tons than the 4,124,850 reported as shown in the next section of the report.

4. ESTIMATE OF
ORE RESERVES

Development in 1946 added 260,497 tons to the engineer's estimate of December 31, 1945 of which 145,114 was disclosed on the fee land, and 115,383 on the leases. The increase in reserves is best explained by listing the component figures as follows:

114,406 tons	Morris standard hoisted.
28,768 "	Morris hoisted
2,276 "	net gain in high sulphur reserve
<u>115,047 tons</u>	" " " Morris reserves
260,497 tons	additional ore placed in sight

All of the above figures are between the estimate dates of December 31, 1945 and December 31, 1946.

The estimated total reserve of 4,124,850 tons at the end of 1946 compared with 4,007,527 in 1945. As mentioned under "Analysis" the increased silica content reported was inconsistent with the tonnage, and the above reserve in place may be expected to run 8% or less silica. The additional reserve on the fee land was disclosed by development which extended No. 84A deposit westerly on the -220' sub level, and on Chase Lease 9 by a crosscut driven northeasterly a total distance of 310' across orebodies 33,75 and 86, all of which were separated by narrow zones of lean ore or dike. The following table summarizes the ore reserve estimate by leases with a list of the above explained changes that occurred during the year:

<u>Description</u>	<u>Estimate</u>	<u>1946 Product</u>		<u>Estimate</u>	<u>Actual</u>	<u>Inc. or Dec. over</u>
	<u>12-31-45</u>	<u>Standard</u>	<u>Morris</u>	<u>Deducting Product</u>	<u>Estimate 12-31-46</u>	
Chase Lease #26	26,140	-	-	26,140	26,140	-
Chase Lease #25	33,273	-	-	33,273	33,273	-
Chase Lease #24	265,628	29,094	6,919	229,615	243,456	13,841
Chase Lease #24 Hi-S.	144,608	-	-	144,608	144,608	-
Chase Lease #9	2,079,128	61,484	13,920	2,003,724	2,105,266	101,542
Total Chase Leases	2,548,777	90,578	20,839	2,437,360	2,552,743	115,383
C.C.I.Co.Lands	1,421,505	23,828	7,929	1,389,748	1,532,586	142,838
C.C.I.Lands Hi-S.	37,245	-	-	37,245	39,521	2,276
Total C.C.I.Lands	1,458,750	23,828	7,929	1,426,993	1,572,107	145,114
GRAND TOTAL	4,007,527	114,406	28,768	3,864,353	4,124,850	260,497

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5. LABOR AND
WAGES

The Morris Mine employees, in company with all other miners in the Lake Superior District, went on strike February 8th for the first time in nearly fifty years over a disagreement on wages. Although the union contract contained a strict "no strike" provision, the Union contended it had the right to use this means of enforcing an industry wide increased wage demand. The issue was complicated by the Office of Price Administration rulings, the disadvantageous position of the underground mines and the absence of true collective bargaining on the subject and after three and one half months, when the 18½¢ per hour increase had become a nationally established pattern, this increase was granted and operations were resumed May 23rd.

The additional cost of \$1.48 per man per day in producing ore necessitated all the more the return to the sub level stope system of mining that Inland management had started in 1945. Following the strike and in June the mine openings were cleaned up and repaired whereupon emphasis was placed on sub stoping and sub caving to increase production. The average tons per man for the year previous to the strike was slightly under five, and for the last four months of 1946 it climbed to 6.50. This increase will probably be extended in 1947 due to the excellent ore reserve position, further mining changes, the easier ore grading procedure, and the increased supply of labor.

The working force in January numbered 161 men. Following the strike in the latter part of May, this reduced to an average of 151, or the low point for some years past. The return of veterans from war service and the considered gradual choosing of new employees raised the total to 176 at the end of the year, or nearly the normal for the 25,000 ton monthly average production of the past several months.

6. SURFACE

As in 1945, there were no special changes or improvements to the surface plant. Plans were made, however, and preliminaries started to divert the Carp River and the mine water discharge northeasterly from the shaft to the Deer Lake storage basin and thus dry the old river bed over the east 9th Level orebody. Negotiations for surface acquisitions for the proposed drainage ditch were materially aided by Mr. C. J. Stakel, Manager, who had served as Supervisor of Ishpeming Township for many years past.

Surface Pumping

Pumping from the surface sand and gravel above ledge in order to reduce the water table over the Morris Mine orebodies averaged 2243 GPM in 1944,

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6. SURFACE (Cont.)

Surface Pumping (Cont.)

2605 GPM in 1945 and 2015 GPM in 1946. The Number 6 well was permanently abandoned on July 5th when the bottom of the well collapsed, and the following table showing the pumping rates at the wells in January and December lists the declines that reduced the average quantity in 1946:

<u>Well Number</u>	<u>GPM</u>	<u>GPM</u>
	<u>January</u>	<u>December</u>
1	210	295
2	58	- **
3	163	119
3A	379	305
5	198	190
6	- *	Caved
8	330	425
9	187	149
10	650	530
TOTAL	2175	2013

* 60 GPM ordinarily. Discharge flume frozen in January.

** 50 GPM ordinarily. Pump motor burned out Dec. 14th.

The pumping rates by months, and the trend in the average water level on the ledge is shown in the next table:

<u>MONTH</u>	<u>Surface Pumping</u>	<u>Drop in Test Holes</u>
	<u>GPM</u>	<u>Feet</u>
January	2174.8	0.3
February	2133.0	0.1
March	2152.4	0.1
April	2191.3	0.1
May	1963.8	0.3
June	1790.8	0.9
July	1925.4	2.0
August	2000.0	2.1
September	1907.0	0.3
October	2105.0	2.6
November	1820.0	0.5
December	2013.0	0.3
Average	2015.	0.2
Avg.1945	2604.6	0.4

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6. SURFACE (Cont.)

The total drop in the average water level since the start of pumping was reported last year as 56'-10-1/8". This average was based on test hole readings within a certain circumscribed area which did not properly extend to the limits now in effect over the various mining territories. The correction to eliminate cumulative errors and more properly portray the average drop in surface water level was made on July 1st when the average was reduced from 56'-7-1/4" to 34'-6-1/4". A summary of the situation to date is the fact that lowering of the water table with deep well pumping has been less effective in the past several years in lowering the water table only 0.4' in 1945 and 0.2' in 1946. The following table records the progress made from the start of surface pumping in 1937, and the depth of water remaining on ledge at the end of the year:

Drop in Feet of Water Level

<u>Test Hole</u>	<u>Aug. 25, 1937</u> <u>Dec. 24, 1946</u>	<u>Depth Remaining</u> <u>to Ledge</u>
501	66.3	26.8
502	-	-
503	81.8	118.0
504	76.1	73.0
505	50.6	79.6
506	55.8	31.5
507	(123.3)	-
508	64.8	68.3
509	67.4	119.3
510	34.2	89.1
511	30.0	124.4
512	47.7	114.0
513	-	-
514	30.2	96.0
515	15.8	112.8
516	31.9	11.7
517	19.6	92.5
518	25.7	82.7
519	54.9	102.6
520	(42.5)	-
521	(28.5)	-
522	18.1	72.1
523	(36.5)	-
524	67.5	32.2
526	11.8	102.2
527	7.7	67.3
528	1.3	98.2
531	8.5	68.0
532	11.6	72.4
533	26.5	105.5
534	0.4	94.3
Peronto Well	(9.4)	-
TOTAL	869.2	2054.5
Average	34.7	82.2

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6. SURFACE (Cont.)

Lower operating repairs, no new development and less water pumped all combined to reduce operating expenses below those of last year. The comparison is shown as follows:

	<u>1945</u>	<u>1946</u>
Average surface pumping rate, GPM	2604.6	2015
Operating Expenditures	\$22,105	\$ 13,960
Cost per ton of ore produced	\$.093	\$.075

7. UNDERGROUND

A. Pumping

The initial Morris Mine surface cave occurred in March 1939, and the following year the water entering the mine reached a high of 1157 GPM. Since 1940 the average has stayed within limits of 844 GPM low and 931 GOM high, and 1946 was no exception with an average of 888.4 GPM pumped from the underground workings.

Extension of the 9th Level development and mining in late years has resulted in an increasing proportion of the total being pumped from this level, as might be expected. The more or less constant decrease on the 7th Level, however, was interrupted in 1946 when the average rose from 146 GPM to 153. The pumping record by levels for the past five years is shown below:

	<u>4th</u>	<u>6th</u>	<u>7th</u>	<u>8th</u>	<u>9th</u>	<u>TOTAL</u>
	<u>Level</u>	<u>Level</u>	<u>Level</u>	<u>Level</u>	<u>Level</u>	
1942	78.2	40.4	277.4	268.8	179.3	844.1
1943	128.5	43.6	237.3	298.3	223.5	931.2
1944	149.2	46.5	180.1	267.0	252.4	895.2
1945	158.4	42.8	146.1	244.0	266.2	857.9
1946	157.3	44.1	153.4	254.9	278.8	888.4

The underground pumping expense amounted to \$46,143, a considerable reduction below the \$61,036 expended in 1945. Pumping plants on the lower levels had been overhauled in 1945, and the saving in this expense and sub normal repairs was responsible for the difference in cost in spite of the slight increase in amount of water handled. A comparison of all pumping costs for the last four years is shown in the following table:

<u>Year</u>	<u>Surface Pumping</u>	<u>Underground</u>	<u>Total Pumping</u>	<u>Cost per ton</u>
	<u>Optg. Expense</u>	<u>Optg. Expense</u>	<u>Optg. Expense</u>	<u>of ore produced</u>
1946	\$ 13,960	\$ 46,143	\$ 60,103	\$.324
1945	22,105	61,036	83,141	.349
1944	41,859	59,219	101,078	.327
1943	20,134	58,521	78,655	.180

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7. UNDERGROUND (Cont.)

b. Development

Development centering mainly above the 9th Level, was carried forward by an average of four contracts during the eight and one half month operating season of 1946. Main level development at the 9th Level elevation had been completed early in 1945, so the program in 1946 was a continuation of the outlining of ore areas above this level preparatory to sub level caving or stoping mining operations. The work was about evenly divided between the new deposit disclosed at the east end of the Fee Lands and the central portion of #33 ore body on Chase Lease #9. Development work throughout the year continued also in ore and lean ore, so that for the third successive year no rock was hoisted from the Morris Mine.

Underground development on the Fee Lands at the east end of the Morris Mine property late in 1945 disclosed the fact that the new ore body was split into two sections, one of which was tributary to the north slate footwall and the second, or south limb, was located on the east-west line of the fault dike trending southwesterly from the footwall. Exploration and development progressed in this south limb of the deposit in 1946 on and above the -220' sub level. This portion of the deposit was numbered 84A to distinguish it from 84B the high sulphur portion of the deposit restricted in area to the extreme east end, and 84C deposit tributary to the north slate footwall. The transfer or scraping sub level drift at the -220' elevation was advanced westerly 230' to the extinction of the ore area, and considerable exploratory raising and drifting in advance of sub level stoping operations was carried on in ore above. This deposit extends upward in about the same area to the elevation of one sub above the 8th Level and mining operations are expected to be underway early in 1947. The outline of the deposit shows it to be of a size and shape adapted to the sub level stope system of mining, and unless water or weak capping develops, the area should enable the continuation of the efficient results secured in the #10 sub level stope on Chase Lease #9 during the latter portion of 1945. At the end of the year, a raise was being put up from the 9th Level to connect with the transfer drift at the west end of the ore body on the -220' sub with the initial expectation of improving ventilation conditions in #6 stope to the east, in which mining was also carried on by sub level stoping methods late in 1946.

Little development was done in 84C deposit, formerly that part of #85 deposit which was explored across the line into the Lloyd Mine property. The exploration raise which was planned to be used as an initial mining raise eastward up the trough between the westward pitching fault and the north footwall, was extended to a point 75' within the Lloyd property and 190' above the 9th Level. This work was done prior to the time of

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7. UNDERGROUND (Cont.)

b. Development (Cont.)

the strike and no further advance was made afterward because evidence on the Morris Mine side of the boundary line indicated above the -220' sub the ore does not extend westward any distance from the intersection of the trough, and this, together with the high phosphorus content of the ore, did not permit further extensive exploration. Discussions were held leading toward the continuation of development in this area, however, with the intention of part time mining, which will permit the mixing of this higher phosphorus ore with the regular mine product and therefore make available for mining that part of the deposit developed to date.

Elsewhere all major development was within Chase Lease #9 and principally on the -220' sub and in raises to the sub level from the 9th Level in the central portion of #33 deposit. Late in 1945 this intermediate sub level drift had been extended easterly to connect raises #914 and #915 with #926. Beginning at the east end of this sub level at #914 raise, a crosscut was driven northeasterly a total distance of 310' across ore bodies #33, #75 and #86, all of which were separated by a narrow zone of lean ore or dike. This timbered drift as it advanced was connected with #913 raise from the north side of the 9th Level drift, and continued into the footwall, and will be extended as a timber slide raise in rock to the 8th Level. Several new raises were put up from the 9th Level to prepare for the downward continuation of mining operations now approaching the 8th Level in the central portion of the deposit. Another new raise was being advanced to the north above the 9th Level near the east end of #33 deposit in order to serve an entirely new stoping area. Also near the east end of #33 deposit, #812 raise was advanced 77' from the 8th Level to the top of the ore at this point, and at the end of the year mining by the sub level caving method was in progress here.

A summary of the development in 1946 indicated an average of four contracts continuing the preparation of the Morris ore bodies above the 9th Level for mining either by the sub level caving or sub level stoping systems. Rather extensive additional development in carrying forward this same purpose is scheduled for 1947. The ore reserve picture was improved by the actual outlining of ore boundaries and there is no reason to suppose that this situation will change in the coming year.

c. Stoping

Mining operations continued on Chase Lease 24, Chase Lease 9 and the Fee Lands to the south and east. The vertical extent of these operations ranged from the 0' sub level on Chase Lease #24 to the -230' sub in the new sub level stopes on both Chase Lease #9 and the Fee Lands to the east.

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7. UNDERGROUND (Cont.)

c. Stoping (Cont.)

The mine product, which averaged something over 20,000 tons per month during the operating months, resulted from an average of 12 mining contracts, together with the ore resulting from the development work described above. The 12 mining contracts compared with an average of 13 in 1945 when the average monthly product was lower, and indicates the improved efficiency of the over-all mining operation by the emphasis on sub level stoping, together with a gradual change from top slicing to the sub level caving system of mining during the last six months of the year. Indicative of the change in methods was the comparison of January 1946 when mining was underway by 11 top slicing and 2 sub level stoping contracts, with December 1946 when there were 2 top slicing contracts, 2 sub level stoping and 7 sub level caving. The change to the single Morris grade in November was of immediate help in the sub level caving areas, and when the supervisory force and the miners become better accustomed to the advantages of the mining system the Morris Mine will have an advantage in silica allowance in the product in making greatest practical use of the sub level caving system. A detailed description of mining operations follows:

Chase Lease #24

Four contracts were mining on the easterly portion of this lease during the year. Three of these contracts continued sub level caving and small scale sub level stoping operations in the westerly portion of #75 deposit on subs from the 00' to the -50'. Nos. 4 and 22 contracts mined approximately two sub levels at the extreme west end of the deposit, and No. 4 contract in December had extended the mining limit under the jasper capping to the north by means of a small sub level stope from the 0' to the -30' sub level. Farther east and adjacent to the Lease 24 and Lease 9 boundary line, No. 21 contract continued sub level caving operations from east to west at the -20' sub level elevation.

No. 9 contract alone continued mining in #82 deposit west of their former sub level stoping area in close proximity to the boundary corner of Leases 9 and 24 and the Fee Lands. No. 9 contract, early in the year, completed an exploration drift westerly from their double compartment raise at the -110' sub level, and when small raise development above this elevation disclosed only lean ore and jasper they moved to the -130' sub (8th Level elevation) and drove an initial caving drift easterly from their raise to the boundary of the caved sub level stope. The remainder of the year was then spent in caving back individual drifts driven both north and south of the main drift, and late in December the contract had begun the opening on the -150' sub by cutting the raise and advancing a small untimbered connection to the traveling road already in existence at this elevation from former sub level stoping operations.

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7. UNDERGROUND (Cont.)

c. Stoping (Cont.)

Chase Lease #24 (Cont.)

Although counted as one of the mining contracts working on the Fee Lands the greater portion of the year, the workings of No. 16 contract at the west end of #33 deposit in October and November extended over into this lease. A small triangular shaped area was sub level caved adjacent to and extending 50' west of the triple boundary corner, with the contract returning to the fee lands in December as the caving drifts advanced to the east on the south side of the mining raise.

Fee Lands

Mining operations, aside from the large amount of development work above the east end of the 9th Level, were restricted to the full time operation of one contract and part time operation of two contracts. The full time mining was by No. 6 contract which started opening their stope in #84A deposit above the transfer on the -250' sub in January. Due to the strike, the stope opening did not reach sufficient size until July to permit efficient operation but from this time forward this contract and No. 10 using the same system of mining in the central portion of #33 deposit, supplied a considerable portion of the regular monthly mine product thereafter. The stope advance was from east to west, and in December the stope face was opened with an average north-south width of nearly 50' and had been extended under the jasper capping to practically the floor of the 8th Level. In other words, at the end of the year this stope had an effective mining height of 100' and from the outline of the ore disclosed at the 8th level elevation further extension is to be expected in 1947, together with the increased production resulting therefrom.

No. 7 contract continued top slicing on the -20' sub level above the 8th Level near the extreme east end of #33 deposit. Mining at the -20' elevation was confined to the pillar south of the raise under the jasper capping and in October this contract dropped to the -50' sub and cut out the raise preparatory to changing over to sub level caving. The initial mining drift was thereupon extended southwesterly to connect with the next 8th Level raise to the west, extending the mining in November and December, therefore, over into Chase Lease #9. The third mining contract on the fee lands was No. 16 which during the first half of the year completed removal of the pillar southeast of their mining raise at the -170' elevation and in September dropped to the -190' sub level in changing over to the sub level caving system of mining. As noted above, during the last half of the year approximately half of the ore produced by this contract

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7. UNDERGROUND (Cont.)

c. Stoping (Cont.)

Fee Lands (Cont.)

came from Chase Lease #24 and the remaining half from the Fee Lands south of the mining raise.

Chase Lease #9

The major portion of production, as in past years, came from the mining operations of an average of six contracts on this lease. The uppermost workings were those of #21 contract, which at times extended easterly across the boundary on the -20' sub level in #75 deposit. At the opposite end of the lease, adjacent to the east boundary line, No. 8 contract continued mining in #33 deposit on the -40' and -50' sub levels, connecting with the workings of No. 5 contract which opened the west end of this territory for mining under the jasper capping by means of the new #812 raise above the 8th Level. As mentioned in a preceding paragraph, the sub caving operations of No. 7 contract also extended on to this lease at the east end of #33 deposit during the last two months of the year.

#15 contract mined a sizeable portion of the central part of #75 deposit with the sub level caving system of mining during the last half of the year. A long scraping drift was extended east of the 8th Level raise on the -80' sub level by this contract, after which short caving drifts on the north side and longer ones on the south side were caved back to the raise from east to west.

At the close of 1946 the top slicing system of mining was still employed by Nos. 2 and 12 contracts in the central portion of #33 deposit. These two contracts consistently mined high grade ore in this area and late in the year the downward continuation of mining was prepared for by the establishment of 9th Level raises to the -100' sub level, a distance of approximately 20' above the 8th Level. Farther east in this same portion of the deposit, No. 3 contract early in the year had explored and mined a narrow portion of the deposit north of #803 raise at the same elevation.

Probably the most productive single operation in 1946 was the sub level stope mining of #10 contract in #75 deposit above their transfer on the -240' sub level. The stope extended as high as the -160' sub under the jasper capping and the greatest advance took place on the -220' sub where at the end of the year an area 125' by 50' had been mined. Provision to extend this stope still farther east was underway during the last half of the year by No. 13 contract who drove a new transfer drift a distance of 135' east of No. 927 raise and extended mining and manway raises above this elevation to the -150' sub, or to a higher elevation than the present back of the stope.

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7. UNDERGROUND (Cont.)

c. Stoping (cont.)

Chase Lease #9 (Cont.)

Late in 1945 and continuing into the beginning of 1946, top slicing operations at the west end of #33 deposit in the extreme southwest corner of the lease was underway on the -180' and -190' sub levels. Several short slices were mined south of #921 raise at the -190' elevation by #12 contract in January and early February. Following the strike, operations were suspended in this lowest portion of the deposit with the exception of #16 contract, whose sub caving operation mainly, however, was confined to Fee Lands and Chase Lease #24. No. 12 contract, as mentioned above, was transferred to the central portion of #33 deposit on the -100' sub where top slicing was still underway at the end of 1946 with the intention of continuing a high grade product from this limited number of producing contracts.

Tilden

8.

a) Comp. Mining Cost

Total Cost at mine

	<u>1926</u>	<u>1945</u>
	1.057	.803

b) Detached Camps

Total Cost at mine

	.867	.626
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↓
Should be total cost
before Depreciation - amort.
and hauling from S.P.

ΣEB - Did C. Shays and
Athens pay for the two
Shovels transferred from Tilden

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1. GENERAL

The Tilden Mine had a very light operation during 1946, being idle from January 1st to June 15th, with only a small crew repairing equipment from May 23rd, when the strike ended, to June 15th. Regular operations really ceased on September 30th, except for a small tonnage stocked on the 14th of October. The last shipment from the pocket was on September 13th, no more ore being required until October 21st, after the trucks and equipment had been stored for the winter, when the ore shipped to the end of the season was then taken from stockpile. Stockpile loading was completed on November 15th. The crew was reduced during October, and the pit was placed on an idle basis during November and December. It is not intended to reopen the pit next year until such a time as the stockpile is almost exhausted and, unless there seems to be a much larger demand for this ore than in 1946, as soon as the stockpile again reaches full capacity, it will again be placed on an idle basis.

The total tonnage loaded from the various pits during 1946 amounted to 101,968 tons, all of regular silica grade, which was a reduction of approximately 95,000 tons below 1945. There were 13,000 tons in addition of low phos. ore loaded in the Summit Pit and stocked in the East Pit when it was expected that a substantial amount of this grade would be shipped. Of the 102,000 tons loaded, only 45,738 tons were shipped from pocket, the balance being placed in stock to take care of late fall and early spring requirements. There were also 49,699 tons shipped from stockpile, making a total of 95,437 tons shipped during 1946.

Ore was loaded in all of the various pits during 1946, and at the end of the season there remained a total of 193,000 tons of broken ore, as compared with 150,000 tons in 1945. Almost all of the ore removed from the East Pit was loaded on the upper bench, mining of which has now produced sufficient width so that future blasts can be made in the lower bench when deemed advisable. 90% of the loading was done with two shovels, the #46 or Marion Shovel and the #52 or 120 Bucyrus Shovel, and since the change from railroad to truck transportation, it has been found that the two 80-B shovels are superfluous, especially when there is no production of low phos. ore. It was decided to move these latter shovels to other mines for stockpile loading and therefore #29 Shovel was dismantled in October and re-erected at the Cliffs Shaft Mine in November, and #31 was dismantled in December and re-erected at the Athens Mine. These electric shovels require only two men to operate as compared with a crew of eight men on the railroad type shovels, which will decrease the labor cost of loading very materially. The ore was transported to the crusher entirely with the 15-ton Euclid trucks, and these units also handled all the ore from pocket to stockpile.

Two blasts were put off during the year, one in the upper bench of the East Pit and one in the lower bench of the West Pit. Since that time another row of holes was drilled in the West Pit and also 11 holes along the upper bench of the East Pit. Previous to 1946 drilling was completed in the East half of the upper bench in the West Pit and in the Summit Pit, and these holes can be blasted whenever necessary. The fragmentation from the two primary blasts was very good, and there was not too much back break to interfere with future drilling.

On account of the excessive height of the bench in the Summit Pit of 100', endangering men and equipment, it was thought best to divide this into two benches of approximately 50' each. As there was approximately \$7,000 remaining in E & A CC 117, which had been authorized for stripping in the West Pit and later had been used to cover additional stripping in the East Pit, it was decided to use part of this balance in stripping and washing to the North and West of the

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1. GENERAL (Cont.)

Summit Pit and also in preparing a new road that will intersect the bench at the half-way point. The cutting off of the second growth, removal of stumps, stripping and washing was completed, and it only remains to finish building the road. All of this work was accomplished during periods when the mine was not operating.

What little extra work was done during the year consisted mainly of repairs to equipment and some improvements and maintenance of the roads.

It is felt that when production is sufficient to warrant the outlay of additional money, that a portable compressor should be purchased for drilling the toe and large chunks in connection with secondary blasting. With labor costs as high as they are at present, it is too costly to maintain air pipe lines over approximately 3/4 of a mile of surface, together with the necessary connections into various parts of the pit. Drilling is also delayed under the present system until such time as the trucks and shovels are not operating, on account of having to cross the pit with the pipes. The cost of delivering air at this distance from the compressor is also higher than would be necessary with portable equipment. An E & A should be authorized for this purchase as soon as it is felt that production warrants this expenditure.

2. PRODUCTION, SHIPMENTS & INVENTORIES

a. Production by Grades

	<u>1946</u>	<u>1945</u>	<u>Decrease</u>
Tilden Silica	101,968	156,837	54,869
Tilden Low Phos.	0	40,639	40,639
Total	101,968	197,476	95,508

b. Shipments

	<u>Pocket</u>	<u>Stockpile</u>	<u>Total</u>	<u>Total Last Year</u>
Tilden Silica	45,738	49,699	95,437	166,017
Tilden Low Phos.				40,639
Total	45,738	49,699	95,437	206,656
Total Last Year	191,454	15,202	206,656	
Increase		34,497		
Decrease	145,716		111,219	

c. Stockpile Inventories

<u>Grade</u>	<u>Balance on Hand Dec. 31, 1945</u>	<u>Stocked 1946</u>	<u>Shipped from Stockpile 1946</u>	<u>Balance on Hand Dec. 31, 1946</u>
Tilden Silica	24,750	56,230	49,699	31,281
Tilden Low Phos.	13,815			13,815
Total	38,565	56,230	49,699	45,096

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2. PRODUCTION, SHIPMENTS & INVENTORIES (Cont.)

e. Product by Months

<u>Month</u>	<u>Days Operated</u>	<u>Average Tonnage Per 8-Hr. Shift</u>	<u>Total Tons</u>
June	13 - 8-hr. Shifts	1,785	23,215
July	23 - 8-hr. Shifts	1,929	44,364
August	11 - 8-hr. Shifts	1,598	17,580
September	11 - 8-hr. Shifts	1,468	16,149
October	1 - 8-hr. Shift	660	660
Total	59 - 8-hr. Shifts	1,728	101,968

The average tons per shift showed quite a decrease due to the small amount produced. This quite often meant a change in operation during a shift, and there is always less production per shift when stocking than when shipping, as some of the trucks have to be employed in stocking the ore, leaving a less number to transport ore from the shovels to the crusher.

Distribution of Product by Pits

	<u>1946</u>	<u>1945</u>	<u>Increase</u>	<u>Decrease</u>
West Pit (Upper Bench)	4,632	2,775	1,857	
West Pit (Lower Bench)	66,617	101,389		34,772
East Pit	30,719	66,827		36,108
Summit Pit	0	26,485		26,485
Total	101,968	197,476		95,508

f. Ore Statement

	<u>Tilden Silica</u>	<u>Tilden Low Phos.</u>	<u>Total</u>	<u>Total Last Year</u>
On Hand January 1, 1946	24,750	13,815	38,565	47,745
Output for Year	101,968		101,968	197,476
Total	126,718	13,815	140,533	245,221
Shipments	95,437		95,437	206,656
Balance on Hand December 31, 1946	31,281	13,815	45,096	38,565

Comparison of Working Schedules, 1944 to 1946

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

1945 - Pit idle January 1st to April 23rd. Small crew drilling and repairing. Operating April 23rd to June 1st, 1 8-hour shift 5 2/3 days per week. June 1st to November 1st, 1 8-hour shift six days per week. (Pit idle week of August 13th for vacation.) Total operating shifts - 97. Idle November 1st to December 1st. Small crew repairing and overhauling equipment. December 1st to December 31st entire crew laid off except for watchman, foreman, and clerk.

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2. PRODUCTION, SHIPMENTS & INVENTORIES

Comparison of Working Schedules, 1944 to 1946 (Cont.)

1944 - Pit idle January 1st to May 1st, small crew drilling, repairing, stripping etc. Operating May 1st to November 1st, 1 8-hour shift five days per week. Total operating shifts - 114. Idle November 1st to December 31st; small crew working same as first of year.

g. Delays

<u>Year</u>	<u>Hours Delay</u>	<u>Total Shifts Operated</u>	<u>Time Lost Per Shift Worked</u>
1946	0	59	
1945	8	97	.158 hrs.
1944	17 $\frac{1}{4}$	114	.190 hrs.
1943	23 $\frac{3}{4}$	81 $\frac{1}{2}$.291 hrs.

3. ANALYSIS

a. Average Mine Analysis on Output

<u>Grade</u>	<u>Iron</u>	<u>Phos.</u>	<u>Sil.</u>	<u>Mang.</u>	<u>Alum.</u>	<u>Lime</u>	<u>Mag.</u>	<u>Sul.</u>	<u>Loss by Ignition</u>
Tilden Silica	39.45	.042	41.53	.06	.86	.30	.22	.010	.21

b. Average Analysis on Straight Cargoes

	<u>Iron</u>	<u>Phos.</u>	<u>Sil.</u>	<u>Mine Phos.</u>	<u>Lake Erie Iron</u>	<u>Moist.</u>
Tilden Silica	39.46	.047	41.58		39.57	2.16

c. Analysis of Ore in Stock

	<u>Iron</u>	<u>Phos.</u>	<u>Sil.</u>	<u>Mang.</u>	<u>Alum</u>	<u>Lime</u>	<u>Mag.</u>	<u>Sul.</u>	<u>Loss</u>	<u>Moist.</u>
Tilden Silica	39.40	.049	41.48	.06	.86	.27	.22	.010	.21	1.55
Tilden Low Phos.	38.00	.018	44.25	.09	.46	.18	.10	.009	.20	1.26

4. ESTIMATE OF ORE RESERVES

a. Developed Ore

1. West Pit - Above Floor at 1430'

Assumption: 13 cu. ft. equal one ton.

Total Stripped & Developed as of Jan. 1, 1946	1,708,180 Tons
Mined during 1946	71,249 "
Total remaining Jan. 1, 1947	1,636,931 Tons

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4. ESTIMATE OF ORE RESERVES

a. Developed Ore (Cont.)

2. East Pit - Above Floor at 1440'

Assumption: 14 cu. ft. equal one ton.

Total Stripped & Developed - 1440' to 1500' as of January 1st, 1946	1,278,320 Tons
Total Stripped & Developed above 1500' as of January 1st, 1946	1,923,964 "
Mined during 1946	30,719 "
Total Remaining above 1500' as of Jan. 1, 1947	<u>1,893,245 "</u>
Total Remaining above 1440' as of Jan. 1, 1947	3,171,565 Tons

3. Summit Pit - Above Floor at 1620'

Assumption: 14 cu. ft. equal one ton.

Total Stripped & Developed as of Jan. 1, 1946	178,618 Tons
Developed by Stripping in 1946	265,000 "
Mined in 1946	0 "
Total Remaining as of Jan. 1, 1947	<u>443,618 Tons</u>

Total Developed Ore as of January 1, 1947:

West Pit	1,636,931 Tons
East Pit	3,171,565 "
Summit Pit	443,618 "
Total All Pits	<u>5,252,114 Tons</u>

Broken Ore in Pits Included Under Developed Ore

	<u>West Pit</u> <u>Lower Bench</u>	<u>East Pit</u>	<u>Summit Pit</u>	<u>Total</u>
January 1, 1947	22,848 Tons	137,846 Tons	32,280 Tons*	192,974 Tons

*Includes 20,016 tons stocked in East Pit.

Total Prospective Ore

<u>West Pit</u>	
Balance remaining in E & A CC 117	500,000 Tons
<u>East & Summit Pits</u>	
Total above Floor at 1500' as of Jan. 1, 1946	2,500,500 Tons
Taken into Developed Ore during 1946	265,000 "
Total Remaining as of Jan. 1, 1947	<u>2,235,500 Tons</u>
Total Prospective Ore January 1st, 1947	2,735,500 Tons

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4. ESTIMATE OF ORE RESERVES (Cont.)

c. Estimated Analysis of Reserves

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

f. Estimate of Production

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

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

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

5. LABOR AND WAGES

a. Comments

There were only the watchmen, foreman and clerk at the Tilden Mine when the men went out on strike on February 8th, and as these men were not eligible to belong to the union, there was no work stoppage until May, when normally there would have been a small crew recalled to start repairs to equipment. The strike was settled on May 21st, at which time the men received an increase of 18½ cents per hour. The regular crew, most of whom had been transferred to other mines since the pit shut down last fall, were gradually returned, and worked continuously on a six-day-per-week schedule until October when curtailment again started. During December only the watchmen, foreman, who acted as day watchman, and the clerk were remaining at this property.

The men were paid their vacation pay in August, but this was in lieu of vacation, as it was necessary at the other properties to keep up production, and this crew was treated accordingly.

- 23 Men, or 72% of the total, received pay for 96 hours.
- 7 Men, or 22% of the total, received pay for 48 hours.

There were two men who have worked 30 years for the Company and eight others have been in the Company's employ for 20 years or longer.

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5. LABOR AND WAGES (Cont.)

b. Comparative Statement of Wages and Product

	<u>1946</u>	<u>1945</u>	<u>Incr.</u>	<u>Decr.</u>
Product	101,968	197,476		95,508
Number of Days Operated	63	97		34
Average Number of Men Working	29	29		
Average Daily Wage	10.19	8.24	1.95	
Tons Per Man Per Day	32.73	47.84		15.11
Labor Cost Per Ton	.311	.173	.138	
Total Number of Days	3,115	4,131		1,016
Amount Paid for Labor	31,760.08	34,042.66		2,282.58

c. Nationality of Employees

	<u>American Born</u>	<u>Foreign Born</u>	<u>Total</u>
English	11	4	15
Swedish	3		3
Norwegian	2		2
Finnish	5	5	10
Irish	4		4
French Canadian	1		1
	<u>26</u>	<u>9</u>	<u>35</u>

7. OPEN PIT OPERATIONS

a. Stripping

An authorization was obtained to use the balance of the money remaining in E & A CC 117 to cover the stripping and washing in connection with dividing the Summit Pit into two benches. As has been explained, the face of the bench here was approximately 100' high, and to make a safer and more economical operation by dividing this into an upper and lower bench, it was necessary to provide a new road for shovels and trucks to the West to serve the upper bench. Rather than strip for the road only, it was felt that it would be more economical to strip a considerable section to the North and West so that an additional length of bench could be operated. The ledge was found to be very uneven, with quite deep pockets, from which the surface could only be removed by washing, and therefore the expense was considerably higher than had been anticipated. This work was done during times the pit was not operating or stocking, and by the end of the year the only remaining work was the grading of the road. Some drilling and blasting will be required near the pit, as this part of the road will have to be cut into the ledge. The second growth was cut off and then the surface stripped as far as possible with the #46 Shovel and the tractor-bull-dozer, the material being loaded into trucks and disposed of in the valley to the South.

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7. OPEN PIT OPERATIONS

a. Stripping (Cont.)

The detail of the expenses to the E & A are as follows:

E & A CC 117 - Tilden Mine Stripping West, East, & Summit Pits

<u>Detail</u>	<u>Amount</u>	<u>Amount Ex-</u> <u>pended 1946</u>	<u>Expended</u> <u>To Date</u>	<u>Unexpended</u>
192,000 yds. @ 12¢ per yd.	23,040.00	2,588.77	20,668.60	2,371.40
10% for Contingencies	2,304.00			2,304.00
Total	<u>25,344.00</u>	<u>2,588.77</u>	<u>20,668.60</u>	<u>4,675.40</u>

- 95,785 yards stripped & washed in West Pit @ .155 per yard.
- 18,524 yards stripped & washed in East Pit in 1945 @ .174 per yard.
- 9,500 yards stripped & washed in Summit Pit in 1946 @ .273 per yard.

265,000 tons of low phos. ore made available by this stripping in the Summit Pit.

f. Drilling, Blasting & Explosives

1. Drilling

On account of the low production during 1946 there was much less drilling required than in 1945. Seven holes were drilled in the lower bench of the West Pit to complete the round started late in 1945. After the blast in this pit in July, a second round of 19 holes was drilled and is ready for blasting next year. The drills were then moved to the East Pit and 13 holes drilled along the East side of the upper bench. Later in the season, after the pit had been shut down, these two 29-T - 9" Bucyrus Erie drills were sent to the Steep Rock Mine in Ontario. They will be returned as soon as needed again at the Tilden Mine, which will probably not be until mid-season, unless there is a much larger demand for this type of ore. Everything is in readiness for a blast in both the East half and lower benches in the West Pit and in the Summit Pit, while there is approximately 140,000 tons of broken ore in the East Pit.

The drilling in the West Pit can be done at much less cost than in the East Pit on account of the flat, regular surface in the former, being the floor of the upper bench. Moving and setting up requires less time, and the actual drilling is also faster on account of less seams and cracks in the formation.

The total cost per foot of drilling for the year showed an increase of 2.7%, but this was much less than the increase in wages and supplies, which was nearer 20%.

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7. OPEN PIT OPERATIONS

f. Drilling, Blasting & Explosives

1. Drilling (Cont.)

Cost of Operating 9-Inch Churn Drills in 1946

	Total Footage Drilled	2,768		
	Average Footage Per Hole	48'		
<u>Operating</u>	<u>Labor</u>	<u>Supplies</u>	<u>Total</u>	<u>Cost Per Foot</u>
Drilling	\$3,113.21	\$ 10.74	\$3,123.95	1.128
Sharpening Bits	809.38	574.62	1,384.00	.500
Pipe & Fittings		173.49	173.49	.062
Electric Power		375.15	375.15	.135
Truck & Tractor	887.52	133.24	1,020.76	.368
Total Operating	\$4,810.11	\$1,267.24	\$6,077.35	2.193
<u>Maintenance</u>				
Drills	463.48	250.97	714.45	.258
Bit Dresser		221.28	221.28	.082
Total Maintenance	\$ 463.48	\$ 472.25	\$ 935.73	.340
Grand Total	\$5,273.59	\$1,739.49	\$7,013.08	2.533

Comparison of Footages and Costs

	<u>1 9 4 6</u>			<u>1 9 4 5</u>		
	<u>Footage Drilled</u>	<u>Footage Per 8-hr. Shift</u>	<u>Cost Per Foot</u>	<u>Footage Drilled</u>	<u>Footage Per 8-hr. Shift</u>	<u>Cost Per Foot</u>
West Pit, Lower Bench	2,234	21.48	2.492	2,887	20.92	2.196
West Pit, East End				553	16.00	2.833
East Pit, Upper Bench	534	19.71	2.697	2,991	18.24	2.588
Summit Pit				1,862	18.43	2.616
	2,768	20.96	2.533	8,293	19.00	2.466

Footage Obtained from Bits

	<u>1 9 4 6</u>		<u>1 9 4 5</u>	
	<u>Bits Used</u>	<u>Footage Per Bit</u>	<u>Bits Used</u>	<u>Footage Per Bit</u>
West Pit, East End			82	6.74
West Pit, Lower Bench	207	10.79	249	11.60
East Pit, Upper Bench	49	10.98	278	10.75
Summit Pit			274	6.77
Total	256	10.91	883	9.39

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7. OPEN PIT OPERATIONS

f. Drilling, Blasting & Explosives

2. Blasting

Only two primary blasts were put off during 1946, both in July in the East and West Pits. The results of the blasts were very satisfactory, as there was good fragmentation and not too much back break to interfere with future drilling. There was sufficient ore broken in these blasts to fulfill the requirements for 1946 and leave ample to start the 1947 season.

The increase in cost of approximately .01 per ton for primary blasting was due entirely to the increased cost of powder and supplies, while the decrease in cost per ton for secondary blasting was the result of better fragmentation in the primary blasts, with therefore less secondary blasting required.

Primary Blasting

<u>Location</u>	<u>Date</u>	<u>No. of Holes</u>	<u>Footage Blasted</u>	<u>Estimated Tonnage</u>	<u>Pounds Explosives</u>	<u>Estimated Tons Ore Per Pound Explosive</u>
East Pit, Upper Bench	7/12/46	35	1,724	65,264	25,550	2.55
West Pit, Lower Bench	7/31/47	30	1,755	70,668	29,200	2.42
		65	3,479	135,932	54,750	2.48

STATEMENT OF EXPLOSIVES USED FOR YEAR 1946

Primary Blasting

<u>Kind</u>		<u>Quantity</u>	<u>Price</u>	<u>Amount</u>
Hercomite 7 $\frac{1}{2}$ x 24	lb.	24,050	.1150	\$2,765.75
E. P. #85, 7 $\frac{1}{2}$ x 24	"	30,700	.1200	3,684.00
Total Powder		54,750	.1178	6,449.75

Blasting Supplies

Primacord Bickford Fuse, Regular M ft.	2,000	32.00	64.00
Primacord Bickford Fuse, Wire Bound "	5,000	40.50	202.50
#6, 6', C W H Electric Blasting Caps	50		4.33
Total Blasting Supplies			270.83

Total All Explosives \$6,720.58

	<u>1946</u>	<u>1945</u>
Total Ore Blasted	135,932	226,320
Tons of Ore per Lb. of Powder	2.48	2.69
Cost per Ton for Powder	.0474	.0401
Cost per Ton for Blasting Supplies	.0020	.0015
Cost per Ton for All Explosives	.0494	.0416
Average Price per Lb. for Powder	.1178	.10795

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7. OPEN PIT OPERATIONS

f. Drilling, Blasting & Explosives

2. Blasting (Cont.)

<u>Kind</u>	<u>Quantity</u>	<u>Price</u>	<u>Amount</u>
<u>Secondary Blasting</u>			
60% Gelatin	lb. 7,650	.1150	\$879.75
 <u>Blasting Supplies</u>			
Connecting Wire	" 4	.55	2.20
Clover Fuse	" 14,300	5.72	81.80
#6 Blasting Caps	M 2,500	12.20	30.50
#7 Hot Wire Lighters	500		3.38
Total Blasting Supplies			<u>\$117.88</u>
Total Secondary Explosives			\$997.63

	<u>1946</u>	<u>1945</u>
Product	101,968	197,476
Pounds of Powder per Ton of Ore	.0750	.0379
Cost per Ton for Powder	.0086	.0043
Cost per Ton for Fuse, Caps, etc.	.0001	.0009
Cost per Ton for All Explosives	.0098	.0052
Average Price per Lb. for Powder	.1150	.1150
Total All Explosives Used at Pit	\$7,718.21	\$10,440.85

Comparison of Blasting Costs

	<u>Primary Blasting</u>	<u>Secondary Blasting</u>
	<u>Cost per Ton Blasted</u>	<u>Cost per Ton Produced</u>
1946	.0494	.0098
1945	.0416	.0052
1944	.0423	.0074
1943	.0468	.0016
1942	.0493	.0035

g. Loading Operations

Loading from the pits, which started on June 15th, was confined mostly to the lower bench in the West Pit and the upper and lower benches of the East Pit. Approximately 13,000 tons of low phos. ore was loaded in the Summit Pit and transferred to the East Pit for easy access to the crushing plant, before it was learned that there were no low phos. requirements for 1947. As the silica requirements were quite small during the year, the stockpile ground was filled to capacity so that it would not be necessary to open the pit as early next year. Loading from the pits ceased on September 13th, and from stockpile on November 15th.