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BASIC ESTIMATED CAPITAL INVESTMENT AND OPERATING COSTS FOR SUBBITUMINOUS AND LIGNITE COAL STRIP MINES

Mines With Annual Production of 3, 4, and 5 MMtpy ROM Coal

by

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ABSTRACT

This study, prepared by the Process Evaluation Office, Division of Systems Engineering, Fossil Energy, estimates typical capital investments, operating costs, and the required selling prices for coal produced from hypothetical subbituminous and lignite strip mines in the Northern Great Plains province. Annual production for the subbituminous mine is 4 million tons; for the lignite mines, it is 3 and 5 million tons. Wage and union welfare rates are those that went into effect under the Western Coal Wage Agreement of 1977. Costs of materials and equipment are based on first-quarter 1979 indexes. It is assumed that the mines have a 20-year life. Two selling prices for coal were determined for each mine--one based on 12-, 15-, and 20-percent returns on equity, and the other based on the same returns with a debt-equity split of 1:2 with 9 percent interest paid on debt dollars.

Investments for the mines are summarized in the following tabulation:

Item	Size of mine, MMtpy		
	3	4	5
Initial capital investment, MM dollars.....	31.5	46.6	73.6
Total capital investment, MM dollars.....	47.8	67.2	101.3

INTRODUCTION

Growing public concern about the increasing demand for energy and the diminishing availability of energy supplies has brought about a renewed interest in coal, America's most abundant fossil energy resource. Since economics is an important factor in determining the extent to which coal will be mined, the Process Evaluation Office of the Department of Energy is preparing reports that will provide estimated capital investment and operating costs for hypothetical coal mines utilizing various mining methods.

This report presents a basic study of capital investment and operating costs for three hypothetical strip mines located in the Northern Great Plains provinces. Since costs are affected by many factors, any particular mine, in reality, will have to be considered in relation to its own special situation and requirements. It is hoped that this report will provide an indication of the

[1]Economist.

approximate economics of strip mining of coal under average conditions.

GENERAL MINING PLAN

The mines are assumed to remove overburden 3 shifts per day, 345 days per year. Coal loading operates 2 shifts per day, 220 days per year. Topsoil is removed with a wheel tractor scraper and stored. The incoming high voltage is reduced to 7,200 volts before it enters the mine power system. Portable substations and power centers will provide proper voltage for each piece of equipment. Overburden drills, stripping equipment, loading shovels, pumps, and lighting equipment are operated by electric power.

The first site, a 3-MMtpy mine, is based on a 20-foot seam of lignite coal with an average of 60 feet of overburden. The overburden is unconsolidated, and blasting is unnecessary. The coal must be blasted before it can be removed. Holes will be drilled on 10-foot centers.

The overburden is removed by a 34-cubic-yard dragline. Overburden from the initial cut is stored; that from subsequent cuts is placed in previously mined areas. A bulldozer will work with the dragline. Coal is loaded into four 100-ton trucks each shift by a 10-cubic-yard electric shovel and is hauled 4 miles over company roads to a loading point. One additional truck is available as a standby unit. A front-end loader is used with the loading shovel for cleanup and loading.

The second site is a 4-MMtpy mine. A 30-foot seam of subbituminous coal has an average overburden of 120 feet. The overburden is consolidated, and blasting is required. Holes will be drilled on 20-foot centers. The coal must also be blasted before it can be removed. Holes will be drilled on 7-foot centers.

The overburden is removed by a 60-cubic-yard dragline. A bulldozer will work with the dragline. After the first cut the dragline will place the overburden in mined-out areas. Coal is loaded by a 15-cubic-yard electric shovel into six 100-ton trucks and hauled 4 miles over company roads to a loading point. One additional truck will be available for standby, and a front-end loader will also work with the loading shovel.

The third site is a 5-MMtpy mine. The 10-foot lignite coal seam has an average overburden of 50 feet. The overburden is unconsolidated and does not require blasting. It is necessary to blast the coal. Holes will be drilled on 10-foot centers.

A 95-cubic-yard dragline removes the overburden. The initial overburden is stored; that from subsequent cuts is placed in previously mined areas. Again, a bulldozer will build a pad for the dragline to move on. A 17-cubic-yard shovel will load coal into six 120-ton trucks that haul it 4 miles to a loading point. Standby truck capacity will also be available, and a front-end loader will work with the loading shovel.

Table 1 describes the principal pieces of equipment.

TABLE 1. - Major equipment list

Equipment and description	Mine size, MMtpy		
	3.0	4.0	5.0
Overburden removal			
Drill		Electric	
Hole diameter, inch		9-7/8	
Maximum bit loading, Mlb		70.0	
Dragline	Electric	Electric	Electric
Bucket capacity, cu yd	34	60	95
Boom length, ft	275	325	360
Dumping radius, ft	240	290	340
Bulldozer:			
Flywheel horsepower	410	410	410
Coal removal and loading:			
Shovel	Electric	Electric	Electric
Bucket capacity, cu yd	10	15	17
Boom length, ft	40.2	65	50
Dumping ht, ft	27.2	46.25	31.75
Front-end loader, rubber-tired:			
Bucket capacity, cu yd	6	6	10
Flywheel horsepower	325	325	680
Coal haulage:			
Truck, bottom dump:			
Capacity, ton	100	100	120
Horsepower	635	635	1,000

Acreages shown in table 2 are necessary to provide the coal needed to sustain a 20-year mining operation.

TABLE 2. - Acreages required to provide coal necessary to sustain a 20-yr operation

Production, tons per year	Average seam thickness, ft	Annual acres required, 90-percent recovery
3,000,000	20	98
4,000,000	30	84
5,000,000	10	327

PREPARATION

Loading run-of-mine (ROM) is no longer the general practice in the coal mining industry; instead, the coal is treated in a coal preparation plant. The degree of beneficiation and, therefore, the cost is determined largely by the product specifications of the intended market and the return to the operator. Current coal preparation processes encompass a broad spectrum of treatment ranging from simple crushing and screening to elaborate systems that include flotation circuits and thermal drying.

Because this study does not relate to a specific mine site, seam, or an exact market, it does not include a preparation plant. To afford the reader an appreciation of costs of coal upgrading, the following general costs are included. Assuming a capacity of 3 million tons per year ROM, the operating cost per ton will vary between $0.08 for breaking only to $3.66 for an elaborate cleaning system.[2] Capital investment will range from $6.8 to $50 million. The above-cited costs are at the May 1978 level.

STORAGE AND UNIT TRAIN LOADING

Facilities for coal storage and unit train loading are included in the economics of the mine model. Included in the storage and loading section are a breaker to separate rock and provide partial sizing prior to storage, belting, feeders, surge bin, automatic loading controls, and track. A sufficient number of unit trains per working day will be loaded to keep up with the output of the mines.

BLACK LUNG BENEFITS REVENUE ACT OF 1977

This tax is imposed on coal sold or used by the producer after March 31, 1978. The producer is liable for the tax for coal mined from a surface mine. The rate is 25 cents per ton or 2 percent of the sale price if the price is less than $12.50 per ton. For purposes of determining both the amount of coal sold by a producer and the sales price of the coal, the point of sale is f.o.b. mine, or f.o.b. cleaning plant if the producer cleans the coal before selling it. Lignite is exempt from the tax.[3] In this study it is arbitrarily assumed that a flat rate of 25 cents per ton tax will be imposed on the subbituminous coal produced and no tax on lignite produced. It is acknowledged that the tax could be less; however, because the operating costs were developed for run-of-mine and not for cleaned coal, and also because of the limitation that there is no account made for coal preparation which would significantly increase the cost of production, the author feels this assumption of 25 cents per ton is not extreme.

SEVERANCE TAX

Table 3 is a partial listing of some states and their respective tax rates A more recent and comprehensive listing of coal severance taxes levied by state is presented in Coal Week.[4] In some states, the severance tax is replaced by another form of taxation. For example, West Virginia has a business and occupa tion tax of $3.85 per $100 value of coal sold. Because this study is not intended to be site specific, a severance tax of $0.83 per ton is used. In developing mining costs for a specific area, one should be aware that severance taxes can be significant and should be included.

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[2]Zimmerman, Raymond E. Preparation Trends. World Coal, v. 4, No. 7, July 1978, pp. 15, 17.

[3]Federal Register, v. 43, No. 66, Apr. 5, 1978, pp. 14305-14307.

[4]Coal Week. Coal and Taxation: U.S. and Canada. Part I, v. 4, No. 16, Apr. 17, 1978, p. 7. Part II, v. 4, No. 17, Apr. 24, 1978, p. 7. Part III, v. 4, No. 18, May 1, 1978, p. 7.

TABLE 3. - Coal severance tax

State	Rate per ton	Percent of value
Alabama.....	$0.335	
Arkansas.....	.02	
Colorado.....	[1].30	
Kentucky.....		4.25
Maryland.....	.15	
Montana.....		[2]35.0
New Mexico.....	[3].38	
North Dakota....	[4].65	
Ohio.....	.04	
Tennessee.....	.20	
Wyoming.....		[5]10.1

[1]Basic severance tax rate 60¢/ton includes credits that cut the rate to 30¢/ton for underground coal and lignite.

[2]30% severance tax on the value of the coal at the mine mouth. County and local taxes on production average about 5%. The total effective tax on coal is about 35%.

[3]Severance tax of 38¢/ton for steam coal and 18¢/ton for metallurgical coal. See footnote 4 of text.

[4]65¢/ton and increases 1¢/ton for every 1% increase in the Producer Price Index. The tax for the first quarter 1978 is 69¢ per ton.

[5]See footnote 4 of text.

ABANDONED MINE RECLAMATION FUND

The abandoned mine reclamation fund, administered by the Office of Surface Mining Reclamation and Enforcement, is used to rectify adverse effects of past mining operations and to alleviate dangers to public health and safety through Federal and state reclamation programs. The fee is 35 cents for surface mined coal except when the surface mined coal is less than $3.50 per ton; then the fee is 10 percent of the value. Lignite is the only exception. The fee for lignite is 10 cents per ton on coal that has a value of $5 or greater; if the value of lignite is less than $5 per ton, the fee is 2 percent of the value. The fee is imposed when coal is sold, or when it is used by the operator. Fees of 35 cents and 10 cents were used in this study for subbituminous and lignite coal respectively.

ESTIMATING PROCEDURES

The time required to develop a mine varys because of the lead time necessary for permit acceptance and equipment delivery and erection. The time period used in this report assumes a point in time after all permits have been accepted.

The cost of reclamation depends on many factors which include, but are not limited to, terrain, soil, vegetation, type and thickness of overburden, thickness of coalbed, ground and surface water, climate, size and type of equipment, method of mining, reclamation laws and regulations, and the operator's method of reclamation. Problems inherent in a specific area may increase reclamation costs by a factor of two or more over those which have been used in this report.

Information supporting the cost figures in this study is included in tables that make up appendixes A, B. and C. The following tables are included for each of the mines:

1. Capital investment summary
2. Manning
3. Depreciation
4. Estimated annual operating cost
5. Working capital and total capital investment
6. Discounted cash flow summary and analysis, 100% equity
7. Discounted cash flow summary and analysis, debt-equity split of 1:2

ASSUMPTIONS

1. Deferred capital cost includes not only the cost of replacing equipment but also the cost of new permanent haulage roads, new power lines, and possible new capital to meet unexpected reclamation and environmental requirements.

2. Equipment and material costs were obtained from recent vendor quotes or literature and other sources. Costs were adjusted to first quarter 1979 using an index furnished by equipment manufacturers.

3. No allowance is made for inflation for future expenditures. At the end of the twentieth year, all assets are disposed of. The value of working capital at that time is the same as its initial value, and all other assets (except coal haulage trucks) are assumed to be fully depreciated with no salvage value.

4. This study does not include costs for coal preparation.

5. There will be an interchange of equipment between reclamation, road building, and other projects. No attempt has been made to judge the percent of time spent on specific projects since so many factors affect the moves.

6. Out of the several different ways that coal properties may be acquired for mining, payment by royalty of 12.5 percent of the selling price was chosen for this study.

7. Discounted cash flows were run for 100 percent equity and for a debt/equity ratio of 1:2. Interest paid on debt was 9 percent.

8. Land reclamation cost does not include the future cost associated with the Surface Mining Control and Reclamation Act of 1977.

Table 4 tabulates specific assumptions used to develop the studies for the mines.

TABLE 4. - Assumptions

Unit	Mine size, MMtpy		
	3.0	4.0	5.0
Overburden removal:			
Average depth, ft.....	60	120	50
Digging conditions[1].....	Medium	Medium-hard	Medium
Average swell factor.....	30%	35%	25%
Drill pattern.....		20' centers	
Powder factor, lb/cu yd..		.4	
Cut width, ft.....	100	100	100
Scheduled operating hours	7,200	7,200	7,200
Operating efficiency.....	.83	.83	.83
Dragline bucket fill factor.....	.8	.8	.8
Coal removal:			
Seam thickness, ft.....	20	30	10
Coal recovery, percent...	90	90	90
Coal density, ton/acre ft	1,700	1,770	1,700
Drill pattern.....	10' centers	7' centers	10' centers
Powder factor, lb/cu yd..	.15	.15	.15
Scheduled operating hours	3,520	3,520	3,520
Operating efficiency.....	.83	.83	.83
Loading shovel fill factor.....	.85	.85	.85
Coal haulage:			
Distance, miles.....	4	4	4

[1]Medium digging--unconsolidated or partially consolidated materials--packed earth, clay.

Medium-hard digging--well blasted limestone, heavy wet clay, weaker ores, gravel with large boulders.

SUMMARY

This report furnishes cost analyses for three hypothetical coal strip mines. A summary of total capital investment, operating cost, royalty, and selling prices is given in table 5.

TABLE 5. - Summary of capital investment, operating cost, royalty, and selling prices by annual output capacity

Item	Mine size, MMtpy		
	3.0	4.0	5.0
Estimated initial capital investment	$31,541,000	$46,590,000	$73,570,000
Estimated deferred capital investment	16,291,000	20,577,000	27,750,000
Total	47,832,000	67,167,000	101,320,000
Capital investment per ton of production	15.94	16.79	20.26
Operating cost per year, without royalty	13,397,300	24,083,700	25,543,600
Operating cost per ton of production	4.47	6.02	5.11
Royalty cost per year:			
100 percent equity:			
12 percent DCF[1]	2,486,800	4,287,200	5,063,600
15 percent DCF	2,724,500	4,579,500	5,619,700
20 percent DCF	3,153,800	5,215,300	6,625,000
Debt/equity ratio = 1:2:			
12 percent DCF	2,393,100	4,151,000	4,762,900
15 percent DCF	2,509,300	4,323,400	5,039,900
20 percent DCF	2,747,100	4,636,000	5,676,500
Selling price per ton:			
100 percent equity:			
12 percent DCF	6.63	8.57	8.10
15 percent DCF	7.27	9.16	8.99
20 percent DCF	8.41	10.43	10.60
Debt/equity ratio = 1:2:			
12 percent DCF	6.38	8.30	7.62
15 percent DCF	6.69	8.65	8.06
20 percent DCF	7.33	9.27	9.08

[1]Discounted cash flow.

APPENDIX A.--3-MMtpy mine

TABLE A-1. - Capital investment summary, 3-MMtpy mine

Item	Quantity	Total cost
Topsoil removal and reclamation:		
Wheel tractor scraper	2	$587,000
Bulldozer	2	534,000
Overburden removal:		
Dragline	1	9,030,000
Cable handler and reel	1	84,000
Bulldozer	1	267,000
Coal removal and loading:		
Coal loading shovel	1	1,687,000
Front-end loader	1	226,000
Coal drill	1	53,000
Explosive truck	1	12,000
Coal haulage, truck	5	1,880,000
Maintenance equipment:		
Road grader	1	168,000
Water truck	1	59,000
Lubrication truck	1	56,000
Fuel truck	1	16,000
Mechanic truck	1	30,000
Welding truck	1	25,000
Electrician truck	1	14,000
Supply truck	1	18,000
Pickup truck	4	32,000
Crane truck	1	126,000
Auxiliary:		
Pump (portable)		11,000
Floodlights and towers		17,000
Communication		18,000
Power setup		702,000
Cable		747,000
Explosive storage facilities		21,000
Office and washhouse		214,000
Shop and warehouse		480,000
Oil and fuel storage		32,000
Initial road construction		160,000
Site preparation		133,000
Exploration		107,000
Environmental study		300,000
Silo and unit train loading facilities		4,014,000
Total direct		21,860,000
Field indirect		437,000
Total construction		22,297,000
Engineering		446,000
Overhead and administration		1,115,000
		23,858,000

TABLE A-1. - Capital investment summary, 3-MMtpy mine - Continued

Item	Quantity	Total cost
Carried forward.....		23,858,000
Contingency.....		3,579,000
		27,437,000
Fee.....		549,000
		27,986,000
Interest during development.....		1,399,000
Net estimate.....		29,385,000

TABLE A-2. - Manning, 3-MMtpy mine

Personnel	Total	Wages[1] per day	Cost per year	Cost per ton
Topsoil removal and reclamation:				
Wheel tractor scraper operator..	6	$87.36	$116,636	
Bulldozer operator.....	6	87.36	116,636	
	12		233,272	$0.08
Overburden removal:				
Bulldozer operator[2].....	3	87.36	111,921	
Dragline operator[2].....	3	92.48	118,374	
Dragline oiler[2].....	3	87.36	111,921	
Dragline groundman[2].....	3	87.36	111,921	
	12		454,137	.15
Coal removal and loading:				
Shovel operator.....	2	92.48	41,132	
Shovel oiler.....	2	87.36	38,878	
Front-end loader operator.....	2	87.36	38,878	
Explosive truck driver.....	2	83.92	36,926	
Pitman.....	6	79.12	105,759	
Driller.....	2	83.92	37,365	
Driller helper.....	2	79.12	35,253	
Shooter.....	1	83.92	18,462	
Shooter helper.....	1	79.12	17,406	
	20		370,059	.12
Coal haulage, truck driver.....	8	83.92	149,459	.05
Maintenance:				
Road grader operator.....	2	87.36	38,878	
Water truck operator.....	2	79.12	35,252	
Fuel truck driver.....	2	79.12	35,252	
Lubrication truck driver.....	3	79.12	53,186	
Supply truck driver.....	2	79.12	35,252	
Mechanic.....	10	89.84	201,079	
Electrician.....	6	89.84	120,525	
Welder.....	6	89.84	120,525	
	33		639,949	.21
Utility, utilityman.....	8	79.12	141,628	.05
Unit train loading:				
Railroad car loader.....	2	83.92	37,364	
Beltman.....	4	79.84	71,140	
	6		108,504	.04
Salary:				
Superintendent.....	1		37,500	
General pit foreman.....	1		25,500	
Pit foreman.....	3		61,500	
Maintenance superintendent.....	1		28,000	
Maintenance foreman.....	3		61,500	
Mining engineer.....	1		29,000	
Geologist.....	1		21,500	
Environmental specialist.....	1		19,500	
Safety inspector.....	3		57,000	
Office manager.....	1		20,500	

TABLE A-2. - Mining, 3-MMtpy mine - Continued

Personnel	Total	Wages[1] per day	Cost per year	Cost per ton
Purchasing agent.	1		20,500	
Timekeeper.	1		14,000	
Bookkeeper.	1		14,000	
Warehouseman.	3		39,000	
	22		449,000	.15
Total labor and supervision.	121		2,546,000	.85

[1]Figures in this column are for the day shift. Shift differentials for other shifts are reflected in the final column. Wages are those established in the Western Surface Coal Mine Agreement of 1977.

[2]345 days per year. All other personnel 220 days per year.

TABLE A-3. - Depreciation schedule, 3-MMtpy mine

Item	Straight-line depreciation, years	Yearly charge, dollars
Topsoil removal and reclamation:		
Wheel tractor scraper	5	105,900
Bulldozer	7	76,300
Overburden removal:		
Dragline	20	451,500
Cable handler and reel	20	4,200
Bulldozer	3	89,000
Coal removal and loading:		
Coal loading shovel	20	84,400
Front-end loader	5	42,000
Coal drill	10	5,300
Explosive truck	5	2,200
Coal haulage, truck	7	233,800
Maintenance equipment:		
Road grader	7	22,200
Water truck	10	5,600
Lubrication truck	10	5,200
Fuel truck	10	1,500
Mechanic truck	5	5,700
Welding truck	5	4,700
Electrician truck	5	2,700
Supply truck	5	3,400
Pickup truck	3	10,100
Crane truck	10	12,000
Auxiliary:		
Pump (portable)	10	1,100
Floodlights and towers	10	1,700
Communication	10	1,800
Power setup	20	35,100
Cable	5	149,400
Explosive storage facilities	20	1,100
Office and washhouse	20	10,700
Shop and warehouse	20	24,000
Oil and fuel storage	20	1,600
Initial road construction	20	8,000
Site preparation	20	6,700
Exploration	20	5,400
Environmental study	20	15,000
Silo and unit train loading facilities	20	200,700
Interim equipment replacement	20	200,000
		1,830,000
Depreciation for field indirect, engineering, overhead and administration, contingency, fee, and interest during development	20	376,300
Total		[1]2,206,300

[1]$0.74 per ton.

NOTE:--Rubber-tired vehicles reflect depreciation excluding tires, which are shown as an operating expense.

TABLE A-4. - Estimated annual operating cost, 3-MMtpy mine

Item	Annual cost	Cost per ton
Direct cost:		
Production:		
Labor	$1,457,100	$0.49
Supervision	359,500	.12
	1,816,600	.61
Maintenance:		
Labor	639,900	.21
Supervision	89,500	.03
	729,400	.24
Total labor and supervision	2,546,000	.85
Operating supplies:		
Spare parts	763,000	.26
Fuel, oil, and lubrication	297,000	.10
Drill bits	43,000	.01
Tires	247,000	.08
Explosives	154,000	.05
Miscellaneous	254,000	.08
	1,758,000	.58
Electricity	486,000	.16
Contracted for discing, mulching, liming, fertilizer, and seeding	600,000	.20
Payroll overhead (40 percent of payroll)	1,018,400	.34
Pension and welfare plans	506,400	.17
Royalty (12.5 percent of selling price)[1]	2,724,500	.91
Severance tax	2,490,000	.83
Strip license	1,000	
Federal reclamation fund	300,000	.10
Indirect cost (15 percent of labor, maintenance, and supplies)	645,600	.21
Fixed cost:		
Taxes and insurance (3 percent of mine cost)	839,600	.28
Depreciation	2,206,300	.74
	3,045,900	1.02
Total	16,121,800	5.37

[1]15 percent discounted cash flow rate of return, 100 percent equity.

TABLE A-5. - Working capital and total capital investment, 3-MMtpy mine

Estimated working capital:		
Direct labor	3 months	$636,500
Operating supplies	do	439,500
Payroll overhead	do	254,600
Indirect cost	4 months	215,200
Fixed cost	0.5% of insurance base	139,900
Strip bond		147,000
Spare parts		291,100
Miscellaneous		32,200
Total working capital		2,156,000
Total estimated capital investment:		
Total plant		27,986,000
Interest during development		1,399,000
Subtotal		29,385,000
Working capital		2,156,000
Estimated initial capital investment		31,541,000
Estimated deferred capital investment		16,291,000
Total capital and deferred investment		[1]47,832,000

[1]This is an average cost of $15.94 per ton of annual production.

TABLE A-6. - Discounted cash flow summary and analysis, 100% equity, 3-MMtpy mine
(Costs, except per-ton selling price, are shown in thousands of dollars)

Year	Capital investment	Net cash flow[1]	Present worth factor at 15%	Present worth capital investment at 15%	Present worth cash flow at 15%	Annual production M tons	Selling price, dollars per ton	Annual sales	Operating cost[2]	Gross profit	Depletion	Taxable income	Federal income tax	Net profit
-1	15,770.5	-15,770.5	1.1500	18,136.1	-18,136.1									
0	15,770.5	-15,770.5	1.0000	15,770.5	-15,770.5									
1	200.0	5,933.0	.8696	173.9	5,159.3	3,000	7.27	21,795.6	16,121.8	5,673.8	2,179.6	3,494.2	1,747.1	1,747.1
2	200.0	5,933.0	.7561	151.2	4,485.9	3,000	7.27	21,795.6	16,121.8	5,673.8	2,179.6	3,494.2	1,747.1	1,747.1
3	499.0	5,634.0	.6575	328.1	3,704.4	3,000	7.27	21,795.6	16,121.8	5,673.8	2,179.6	3,494.2	1,747.1	1,747.1
4	200.0	5,933.0	.5718	114.4	3,392.5	3,000	7.27	21,795.6	16,121.8	5,673.8	2,179.6	3,494.2	1,747.1	1,747.1
5	1,859.0	4,274.0	.4972	924.3	2,125.0	3,000	7.27	21,795.6	16,121.8	5,673.8	2,179.6	3,494.2	1,747.1	1,747.1
6	499.0	5,634.0	.4323	215.7	2,435.6	3,000	7.27	21,795.6	16,121.8	5,673.8	2,179.6	3,494.2	1,747.1	1,747.1
7	2,782.0	3,351.0	.3759	1,045.9	1,259.6	3,000	7.27	21,795.6	16,121.8	5,673.8	2,179.6	3,494.2	1,747.1	1,747.1
8	200.0	5,933.0	.3269	65.4	1,939.5	3,000	7.27	21,795.6	16,121.8	5,673.8	2,179.6	3,494.2	1,747.1	1,747.1
9	499.0	5,634.0	.2843	141.8	1,601.7	3,000	7.27	21,795.6	16,121.8	5,673.8	2,179.6	3,494.2	1,747.1	1,747.1
10	2,215.0	3,918.0	.2472	547.5	968.5	3,000	7.27	21,795.6	16,121.8	5,673.8	2,179.6	3,494.2	1,747.1	1,747.1
11	200.0	5,933.0	.2149	43.0	1,275.0	3,000	7.27	21,795.6	16,121.8	5,673.8	2,179.6	3,494.2	1,747.1	1,747.1
12	499.0	5,634.0	.1869	93.3	1,053.0	3,000	7.27	21,795.6	16,121.8	5,673.8	2,179.6	3,494.2	1,747.1	1,747.1
13	200.0	5,933.0	.1625	32.5	964.1	3,000	7.27	21,795.6	16,121.8	5,673.8	2,179.6	3,494.2	1,747.1	1,747.1
14	2,782.0	3,351.0	.1413	393.2	473.5	3,000	7.27	21,795.6	16,121.8	5,673.8	2,179.6	3,494.2	1,747.1	1,747.1
15	2,158.0	3,975.0	.1229	265.2	488.5	3,000	7.27	21,795.6	16,121.8	5,673.8	2,179.6	3,494.2	1,747.1	1,747.1
16	200.0	5,933.0	.1069	21.4	634.2	3,000	7.27	21,795.6	16,121.8	5,673.8	2,179.6	3,494.2	1,747.1	1,747.1
17	200.0	5,933.0	.0929	18.6	551.2	3,000	7.27	21,795.6	16,121.8	5,673.8	2,179.6	3,494.2	1,747.1	1,747.1
18	499.0	5,634.0	.0808	40.3	455.2	3,000	7.27	21,795.6	16,121.8	5,673.8	2,179.6	3,494.2	1,747.1	1,747.1
19	200.0	5,933.0	.0703	14.1	417.1	3,000	7.27	21,795.6	16,121.8	5,673.8	2,179.6	3,494.2	1,747.1	1,747.1
20	-2,424.5	8,557.5	.0611	-148.1	522.9	3,000	7.27	21,795.6	16,121.8	5,673.8	2,179.6	3,494.2	1,747.1	1,747.1
				38,388.3	.1									

[1]Net cash flow is depreciation + depletion + net profit - capital investment.
[2]Includes $2,724,500 royalty; $0.91 per ton.

TABLE A-7. - Discounted cash flow summary and analysis, debt-equity split of 1:2, 3-MMtpy mine
(Costs, except per-ton selling prices, are in thousands of dollars)

Year	Capital investment	Debt	Equity	Present worth factor at 15%	Debt plus accrued interest	Present worth equity at 15%	Net annual cash flow[1]	Present worth of net cash flow at 15%	Annual interest payment at 9%	Annual principal repayment	Annual production M tons	Annual sales	Selling price, dollars per ton	Operating cost[2]	Gross profit	Depletion	Taxable income	Federal income tax	Profit	Net profit
-1	15,770.5	5,204.3	10,566.2	1.1500	5,672.6	12,151.2	-10,566.2	-12,151.2												
0	15,770.5	5,204.3	10,566.2	1.0000	5,204.3	10,566.2	-10,566.2	-10,566.2												
1	200.0		200.0	.8696		173.9	4,185.3	3,639.5	978.9	212.6	3,000	20,074.3	6.69	16,885.5	3,188.8	1,594.4	1,594.4	797.2	797.2	584.6
2	200.0		200.0	.7561		151.2	4,180.5	3,160.9	959.8	231.7	3,000	20,074.3	6.69	16,866.4	3,207.9	1,603.9	1,604.0	802.0	802.0	570.3
3	499.0		499.0	.6575		328.1	3,876.3	2,548.7	938.9	252.6	3,000	20,074.3	6.69	16,845.5	3,228.8	1,614.4	1,614.4	807.2	807.2	554.6
4	200.0		200.0	.5718		114.4	4,169.6	2,384.2	916.2	275.3	3,000	20,074.3	6.69	16,822.8	3,251.5	1,625.7	1,625.8	812.9	812.9	537.6
5	1,859.0		1,859.0	.4972		924.3	2,504.4	1,245.2	891.4	300.1	3,000	20,074.3	6.69	16,798.0	3,276.3	1,638.1	1,638.2	819.1	819.1	519.0
6	499.0		499.0	.4323		215.7	3,857.7	1,667.7	864.4	327.1	3,000	20,074.3	6.69	16,771.0	3,303.3	1,651.7	1,651.6	825.8	825.8	498.7
7	2,782.0		2,782.0	.3759		1,045.9	1,567.3	589.1	835.0	356.5	3,000	20,074.3	6.69	16,741.6	3,332.7	1,666.3	1,666.4	833.2	833.2	476.7
8	200.0		200.0	.3269		65.4	4,141.3	1,353.8	802.9	388.6	3,000	20,074.3	6.69	16,709.5	3,364.8	1,682.4	1,682.4	841.2	841.2	452.6
9	499.0		499.0	.2843		141.8	3,833.5	1,089.9	767.9	423.6	3,000	20,074.3	6.69	16,674.5	3,399.8	1,699.9	1,699.9	850.0	849.9	426.3
10	2,215.0		2,215.0	.2472		547.5	2,108.0	521.1	729.8	461.7	3,000	20,074.3	6.69	16,636.4	3,437.9	1,718.9	1,719.0	859.5	859.5	397.8
11	200.0		200.0	.2149		43.0	4,112.6	883.8	688.2	503.3	3,000	20,074.3	6.69	16,594.8	3,479.5	1,739.7	1,739.8	869.9	869.9	366.6
12	499.0		499.0	.1869		93.3	3,802.3	710.6	642.9	548.6	3,000	20,074.3	6.69	16,549.5	3,524.8	1,762.4	1,762.4	881.2	881.2	332.6
13	200.0		200.0	.1625		32.5	4,088.9	664.4	593.5	598.0	3,000	20,074.3	6.69	16,500.1	3,574.2	1,787.1	1,787.1	893.6	893.5	295.5
14	2,782.0		2,782.0	.1413		393.2	1,493.5	211.0	539.7	651.8	3,000	20,074.3	6.69	16,446.3	3,628.0	1,814.0	1,814.0	907.0	907.0	255.2
15	2,158.0		2,158.0	.1229		265.2	2,102.8	258.4	481.1	710.4	3,000	20,074.3	6.69	16,387.7	3,686.6	1,843.3	1,843.3	921.7	921.6	211.2
16	200.0		200.0	.1069		21.4	4,044.8	432.4	417.1	774.4	3,000	20,074.3	6.69	16,323.7	3,750.6	1,875.3	1,875.3	937.7	937.6	163.2
17	200.0		200.0	.0929		18.6	4,027.4	374.1	347.4	844.1	3,000	20,074.3	6.69	16,254.0	3,820.3	1,910.1	1,910.2	955.1	955.1	111.0
18	499.0		499.0	.0808		40.3	3,709.4	299.7	271.4	920.1	3,000	20,074.3	6.69	16,178.0	3,896.3	1,948.1	1,948.2	974.1	974.1	54.0
19	200.0		200.0	.0703		14.1	3,987.7	280.3	188.6	1,002.9	3,000	20,074.3	6.69	16,095.2	3,979.1	1,989.5	1,989.6	994.8	994.8	-8.1
20	-2,424.5		-2,424.5	.0611		-148.1	6,576.1	401.8	98.4	1,093.1	3,000	20,074.3	6.69	16,005.0	4,069.3	2,007.3	2,062.0	1,031.0	1,031.0	-62.1
						27,199.1		-0.8												

[1]Net cash flow is depreciation + depletion + net profit - capital investment.
[2]Includes $2,509,300 royalty; $0.84 per ton.

APPENDIX B.--4-MMtpy mine

TABLE B-1. - Capital investment summary, 4-MMtpy mine

Item	Quantity	Total cost
Topsoil removal and reclamation:		
Wheel tractor scraper	2	$587,000
Bulldozer	2	534,000
Overburden removal:		
Dragline	1	15,880,000
Cable handler and reel	1	84,000
Drill	3	1,626,000
Bulldozer	1	267,000
Explosive truck	1	12,000
Nitrate truck	1	34,000
Coal removal and loading:		
Coal loading shovel	1	2,110,000
Front-end loader	1	226,000
Coal drill	2	107,000
Coal haulage, truck	7	2,632,000
Maintenance equipment:		
Road grader	1	168,000
Water truck	1	59,000
Lubrication truck	1	56,000
Fuel truck	1	16,000
Mechanic truck	1	30,000
Welding truck	1	25,000
Electrician truck	1	14,000
Supply truck	1	18,000
Pickup truck	4	32,000
Crane truck	1	126,000
Auxiliary:		
Pump (portable)		11,000
Floodlights and towers		17,000
Communication		18,000
Power setup		702,000
Cable		747,000
Explosive storage facilities		53,000
Office and washhouse		214,000
Shop and warehouse		534,000
Oil and fuel storage		32,000
Initial road construction		160,000
Site preparation		133,000
Exploration		107,000
Environmental study		300,000
Silo and unit train loading facilities		4,060,000
Total direct		31,731,000
Field indirect		635,000
Total construction		32,366,000

TABLE B-1. - Capital investment summary, 4-MMtpy mine - Continued

Item	Quantity	Total cost
Total construction, carried forward...		32,366,000
Engineering.....		647,000
Overhead and administration.....		1,618,000
		34,631,000
Contingency.....		5,195,000
		39,826,000
Fee.....		797,000
		40,623,000
Interest during development.....		2,031,000
Net estimate.....		42,654,000

TABLE B-2. - Manning, 4-MMtpy mine

Personnel	Total	Wages[1] per day	Cost per year	Cost per ton
Topsoil removal and reclamation:				
Wheel tractor scraper operator.	6	$87.36	$116,636	
Bulldozer operator.....	6	87.36	116,636	
	12		233,272	$0.06
Overburden removal:				
Bulldozer operator[2].....	3	87.36	111,921	
Drill operator[2].....	6	83.92	213,998	
Drill helper[2].....	6	79.12	201,902	
Shooter.....	2	83.92	36,925	
Shooter helper.....	2	79.12	34,813	
Dragline operator[2].....	3	92.48	118,374	
Dragline oiler[2].....	3	87.36	111,921	
Dragline groundman[2].....	3	87.36	111,921	
Dragline mechanic[2].....	3	89.84	115,021	
Explosive truck driver.....	2	83.92	36,925	
Nitrate truck driver.....	2	83.92	36,925	
	35		1,130,646	.28
Coal removal and loading:				
Shovel operator.....	2	92.48	41,132	
Shovel oiler.....	2	87.36	38,878	
Front-end loader operator.....	2	87.36	38,878	
Pitman.....	8	79.12	141,012	
Driller.....	4	83.92	74,730	
Driller helper.....	4	79.12	70,506	
Shooter.....	2	83.92	36,925	
Shooter helper.....	2	79.12	34,813	
	26		476,874	.12
Coal haulage, truck driver.....	12	83.92	224,188	.06
Maintenance:				
Road grader operator.....	2	87.36	38,878	
Water truck driver.....	2	79.12	35,252	
Fuel truck driver.....	2	79.12	35,252	
Lubrication truck driver.....	3	79.12	53,186	
Supply truck driver.....	2	79.12	35,252	
Mechanic.....	12	89.84	241,665	
Electrician.....	7	89.84	140,818	
Welder.....	7	89.84	140,818	
	37		721,121	.18
Utility, utilityman.....	10	79.12	176,881	.04
Unit train loading:				
Railroad car loader.....	2	83.92	37,364	
Beltman.....	4	79.84	71,140	
	6		108,504	.03
Salary:				
Superintendent.....	1		37,500	
General pit foreman.....	1		25,500	
Pit foreman.....	3		61,500	
Maintenance superintendent.....	1		28,000	

TABLE B-2. - Manning, 4-MMtpy mine - Continued

Personnel	Total	Wages[1] per day	Cost per year	Cost per ton
Maintenance foreman.	3		61,500	
Mining engineer.	1		29,000	
Geologist.	1		21,500	
Environmental specialist	1		19,500	
Safety inspector	3		57,000	
Office manager	1		20,500	
Purchasing agent	1		20,500	
Timekeeper	1		14,000	
Bookkeeper	1		14,000	
Warehouseman	3		39,000	
	22		449,000	.11
Total labor and supervision. .	160		3,520,500	.88

[1]Figures in this column are for the day shift. Shift differentials for other shifts are reflected in the final column. Wages are those established in the Western Surface Coal Mine Agreement of 1977.

[2]345 days per year. All other personnel 220 days per year.

TABLE B-3. - Depreciation schedule, 4-MMtpy mine

Item	Straight-line depreciation, years	Yearly charge, dollars
Topsoil removal and reclamation:		
Wheel tractor scraper	5	105,900
Bulldozer	7	76,300
Overburden removal:		
Dragline	20	794,000
Cable handler and reel	20	4,200
Drill	10	162,600
Bulldozer	3	89,000
Explosive truck	5	2,200
Nitrate truck	5	6,500
Coal removal and loading:		
Coal loading shovel	20	105,500
Front-end loader	5	42,000
Coal drill	10	10,700
Coal haulage, truck	7	326,900
Maintenance equipment:		
Road grader	7	22,200
Water truck	10	5,600
Lubrication truck	10	5,200
Fuel truck	10	1,500
Mechanic truck	5	5,700
Welding truck	5	4,700
Electrician truck	5	2,700
Supply truck	5	3,400
Pickup truck	3	10,100
Crane truck	10	12,000
Auxiliary:		
Pump (portable)	10	1,100
Floodlights and towers	10	1,700
Communication	10	1,800
Power setup	20	35,100
Cable	5	149,400
Explosive storage facilities	20	2,700
Office and washhouse	20	10,700
Shop and warehouse	20	26,700
Oil and fuel storage	20	1,600
Initial road construction	20	8,000
Site preparation	20	6,700
Exploration	20	5,400
Environmental study	20	15,000
Silo and unit train loading facilities	20	203,000
Interim equipment replacement	20	250,000
		2,517,800
Depreciation for field indirect, engineering, overhead and administration, contingency, fee, and interest during development	20	546,200
Total		[1]3,064,000

[1]$0.77 per ton.

NOTE:--Rubber-tired vehicles reflect depreciation excluding tires, which are shown as an operating expense.

TABLE B-4. - Estimated annual operating cost, 4-MMtpy mine

Item	Annual cost	Cost per ton
Direct cost:		
Production:		
Labor	$2,350,400	$0.59
Supervision	359,500	.09
	2,709,900	.68
Maintenance:		
Labor	721,100	.18
Supervision	89,500	.02
	810,600	.20
Total labor and supervision	3,520,500	.88
Operating supplies:		
Spare parts	1,224,000	.31
Fuel, oil, and lubrication	387,000	.10
Drill bit	294,000	.07
Tires	339,000	.08
Explosives	2,709,000	.68
Miscellaneous	408,000	.10
	5,361,000	1.34
Electricity	990,000	.25
Contracted for discing, mulching, liming, fertilizer, and seeding	800,000	.20
Payroll overhead (40 percent of payroll)	1,408,200	.35
Pension and welfare plans	668,100	.17
Royalty (12.5 percent of selling price)[1]	4,579,500	1.15
Severance tax	3,320,000	.83
Strip license	1,000	
Federal reclamation fund	1,400,000	.35
Black lung benefit tax	1,000,000	.25
Indirect cost (15 percent of labor, maintenance, and supplies)	1,332,200	.33
Fixed cost:		
Taxes and insurance (3 percent of mine cost)	1,218,700	.30
Depreciation	3,064,000	.77
	4,282,700	1.07
Total	28,663,200	7.17

[1]15 percent discounted cash flow rate of return, 100 percent equity.

TABLE B-5. - Working capital and total capital investment, 4-MMtpy mine

Estimated working capital:		
Direct labor	3 months	$880,100
Operating supplies	do	1,340,300
Payroll overhead	do	352,100
Indirect cost	4 months	444,100
Fixed cost	0.5% of insurance base	203,100
Strip bond		126,000
Spare parts		531,300
Miscellaneous		59,000
Total working capital		3,936,000
Total estimated capital investment:		
Total plant		40,623,000
Interest during development		2,031,000
Subtotal		42,654,000
Working capital		3,936,000
Estimated initial capital investment		46,590,000
Estimated deferred capital investment		20,577,000
Total capital and deferred investment		[1]67,167,000

[1]This is an average cost of $16.79 per ton of annual production.

TABLE B-6. - Discounted cash flow summary and analysis, 100% equity, 4-MMtpy mine
(Costs, except per-ton selling price, are shown in thousands of dollars)

Year	Capital investment	Net cash flow[1]	Present worth factor at 15%	Present worth capital investment at 15%	Present worth cash flow at 15%	Annual production M tons	Selling price, dollars per ton	Annual sales	Operating cost[2]	Gross profit	Depletion	Taxable income	Federal income tax	Net profit
-1	23,295	-23,295.0	1.1500	26,789.3	-26,789.3									
0	23,295	-23,295.0	1.0000	23,295.0	-23,295.0									
1	250	8,632.3	.8696	217.4	7,506.6	4,000	9.16	36,636.3	28,663.2	7,973.1	3,663.6	4,309.5	2,154.8	2,154.7
2	250	8,632.3	.7561	189.0	6,526.9	4,000	9.16	36,636.3	28,663.2	7,973.1	3,663.6	4,309.5	2,154.8	2,154.7
3	549	8,333.3	.6575	361.0	5,479.1	4,000	9.16	36,636.3	28,663.2	7,973.1	3,663.6	4,309.5	2,154.8	2,154.7
4	250	8,632.3	.5718	142.9	4,935.9	4,000	9.16	36,636.3	28,663.2	7,973.1	3,663.6	4,309.5	2,154.8	2,154.7
5	1,943	6,939.3	.4972	966.0	3,450.2	4,000	9.16	36,636.3	28,663.2	7,973.1	3,663.6	4,309.5	2,154.8	2,154.7
6	549	8,333.3	.4323	237.3	3,602.5	4,000	9.16	36,636.3	28,663.2	7,973.1	3,663.6	4,309.5	2,154.8	2,154.7
7	3,584	5,298.3	.3759	1,347.4	1,991.6	4,000	9.16	36,636.3	28,663.2	7,973.1	3,663.6	4,309.5	2,154.8	2,154.7
8	250	8,632.3	.3269	81.7	2,821.9	4,000	9.16	36,636.3	28,663.2	7,973.1	3,663.6	4,309.5	2,154.8	2,154.7
9	549	8,333.3	.2843	156.1	2,369.2	4,000	9.16	36,636.3	28,663.2	7,973.1	3,663.6	4,309.5	2,154.8	2,154.7
10	3,979	4,903.3	.2472	983.5	1,212.1	4,000	9.16	36,636.3	28,663.2	7,973.1	3,663.6	4,309.5	2,154.8	2,154.7
11	250	8,632.3	.2149	53.7	1,855.1	4,000	9.16	36,636.3	28,663.2	7,973.1	3,663.6	4,309.5	2,154.8	2,154.7
12	549	8,333.3	.1869	102.6	1,557.5	4,000	9.16	36,636.3	28,663.2	7,973.1	3,663.6	4,309.5	2,154.8	2,154.7
13	250	8,632.3	.1625	40.6	1,402.7	4,000	9.16	36,636.3	28,663.2	7,973.1	3,663.6	4,309.5	2,154.8	2,154.7
14	3,584	5,298.3	.1413	506.5	748.6	4,000	9.16	36,636.3	28,663.2	7,973.1	3,663.6	4,309.5	2,154.8	2,154.7
15	2,242	6,640.3	.1229	275.5	816.1	4,000	9.16	36,636.3	28,663.2	7,973.1	3,663.6	4,309.5	2,154.8	2,154.7
16	250	8,632.3	.1069	26.7	922.8	4,000	9.16	36,636.3	28,663.2	7,973.1	3,663.6	4,309.5	2,154.8	2,154.7
17	250	8,632.3	.0929	23.2	801.9	4,000	9.16	36,636.3	28,663.2	7,973.1	3,663.6	4,309.5	2,154.8	2,154.7
18	549	8,333.3	.0808	44.4	673.3	4,000	9.16	36,636.3	28,663.2	7,973.1	3,663.6	4,309.5	2,154.8	2,154.7
19	250	8,632.3	.0703	17.6	606.9	4,000	9.16	36,636.3	28,663.2	7,973.1	3,663.6	4,309.5	2,154.8	2,154.7
20	-4,262	13,144.3	.0611	-260.4	803.0	4,000	9.16	36,636.3	28,663.2	7,973.1	3,663.6	4,309.5	2,154.8	2,154.7
				55,597.0	-.4									

[1]Net cash flow is depreciation + depletion + net profit - capital investment.
[2]Includes $4,579,500 royalty; $1.14 per ton.

TABLE B-7. - Discounted cash flow summary and analysis, debt-equity split of 1:2, 4-MMtpy mine
(Costs, except per-ton selling price, are shown in thousands of dollars)

Year	Capital investment	Debt	Equity	Present worth factor at 15%	Debt plus accrued interest	Present worth equity at 15%	Net annual cash flow[1]	Present worth of net cash flow at 15%	Annual interest payment at 9%	Annual principal repayment	Annual production, M tons	Annual sales	Selling price, dollars per ton	Operating cost[2]	Gross profit	Depletion	Taxable income	Federal income tax	Profit	Net profit
-1	23,295	7,687.3	15,607.7	1.1500	8,379.2	17,948.8	-15,607.7	-17,948.8												
0	23,295	7,687.3	15,607.7	1.0000	7,687.3	15,607.7	-15,607.7	-15,607.7												
1	250		250.0	.8696		217.4	6,050.8	5,261.8	1,446.0	314.0	4,000	34,587.5	8.65	29,853.1	4,734.4	2,367.2	2,367.2	1,183.6	1,183.6	869.6
2	250		250.0	.7561		189.0	6,043.7	4,569.6	1,417.7	342.3	4,000	34,587.5	8.65	29,824.8	4,762.7	2,381.3	2,381.4	1,190.7	1,190.7	848.4
3	549		549.0	.6575		361.0	5,737.0	3,772.1	1,386.9	373.1	4,000	34,587.5	8.65	29,794.0	4,793.5	2,396.7	2,396.8	1,198.4	1,198.4	825.3
4	250		250.0	.5718		142.9	6,027.6	3,446.6	1,353.3	406.7	4,000	34,587.5	8.65	29,760.4	4,827.1	2,413.5	2,413.6	1,206.8	1,206.8	800.1
5	1,943		1,943.0	.4972		966.0	4,325.5	2,150.6	1,316.7	443.3	4,000	34,587.5	8.65	29,723.8	4,863.7	2,431.9	2,431.8	1,215.9	1,215.9	772.6
6	549		549.0	.4323		237.3	5,709.5	2,468.2	1,276.8	483.2	4,000	34,587.5	8.65	29,683.9	4,903.6	2,451.8	2,451.8	1,225.9	1,225.9	742.7
7	3,584		3,584.0	.3759		1,347.4	2,663.2	1,001.1	1,233.3	526.7	4,000	34,587.5	8.65	29,640.9	4,946.6	2,473.3	2,473.3	1,236.7	1,236.6	709.9
8	250		250.0	.3269		81.7	5,985.8	1,956.8	1,185.9	574.1	4,000	34,587.5	8.65	29,593.0	4,994.5	2,497.3	2,497.2	1,248.6	1,248.6	674.5
9	549		549.0	.2843		156.1	5,673.9	1,613.1	1,134.3	625.7	4,000	34,587.5	8.65	29,541.4	5,046.1	2,523.1	2,523.0	1,261.5	1,261.5	635.8
10	3,979		3,979.0	.2472		983.5	2,229.8	551.2	1,077.9	682.1	4,000	34,587.5	8.65	29,485.0	5,102.5	2,551.3	2,551.2	1,275.6	1,275.6	593.5
11	250		250.0	.2149		53.7	5,943.4	1,277.2	1,016.6	743.4	4,000	34,587.5	8.65	29,423.7	5,163.8	2,581.9	2,581.9	1,291.0	1,290.9	547.5
12	549		549.0	.1869		102.6	5,627.7	1,051.8	949.6	810.4	4,000	34,587.5	8.65	29,356.7	5,230.8	2,615.4	2,615.4	1,307.7	1,307.7	497.3
13	250		250.0	.1625		40.6	5,908.5	960.1	876.7	883.3	4,000	34,587.5	8.65	29,283.8	5,303.7	2,651.9	2,651.8	1,325.9	1,325.9	442.6
14	3,584		3,584.0	.1413		506.5	2,554.6	361.0	797.2	962.8	4,000	34,587.5	8.65	29,204.3	5,383.2	2,691.6	2,691.6	1,345.8	1,345.8	383.0
15	2,242		2,242.0	.1229		275.5	3,874.9	476.2	710.6	1,049.4	4,000	34,587.5	8.65	29,117.7	5,469.8	2,734.9	2,734.9	1,367.5	1,367.4	318.0
16	250		250.0	.1069		26.7	5,843.3	624.6	616.1	1,143.9	4,000	34,587.5	8.65	29,023.2	5,564.3	2,782.1	2,782.2	1,391.1	1,391.1	247.2
17	250		250.0	.0929		23.2	5,817.6	540.5	513.2	1,246.8	4,000	34,587.5	8.65	28,920.3	5,667.2	2,833.6	2,833.6	1,416.8	1,416.8	170.0
18	549		549.0	.0808		44.4	5,490.5	443.6	400.9	1,359.1	4,000	34,587.5	8.65	28,808.0	5,779.5	2,889.7	2,889.8	1,444.9	1,444.9	85.8
19	250		250.0	.0703		17.6	5,758.9	404.9	278.6	1,481.4	4,000	34,587.5	8.65	28,685.7	5,901.8	2,950.9	2,950.9	1,475.5	1,475.4	-6.0
20	-4,262		-4,262.0	.0611		-260.4	10,237.6	625.5	145.3	1,614.7	4,000	34,587.5	8.65	28,552.4	6,035.1	3,017.5	3,017.6	1,508.8	1,508.8	-105.9
						39,069.2		0												

[1]Net cash flow is depreciation + depletion + net profit - capital investment.
[2]Includes $4,323,400 royalty; $1.08 per ton.

APPENDIX C.--5-MMtpy mine

TABLE C-1. - Capital investment summary, 5-MMtpy mine

Item	Quantity	Total cost
Topsoil removal and reclamation:		
Wheel tractor scraper	4	$1,174,000
Bulldozer	4	1,068,000
Overburden removal:		
Dragline	1	31,980,000
Cable handler and reel	1	84,000
Bulldozer	1	267,000
Coal removal and loading:		
Coal loading shovel	1	2,332,000
Front-end loader	1	352,000
Coal drill	2	107,000
Explosive truck	1	12,000
Coal haulage, truck	8	4,624,000
Maintenance equipment:		
Road grader	2	336,000
Water truck	2	118,000
Lubrication truck	1	56,000
Fuel truck	1	16,000
Mechanic truck	2	60,000
Welding truck	2	50,000
Electrician truck	2	28,000
Supply truck	1	18,000
Pickup truck	6	48,000
Crane truck	1	126,000
Auxiliary:		
Pump (portable)		16,000
Floodlights and towers		21,000
Communication		21,000
Power setup		702,000
Cable		747,000
Explosive storage facilities		27,000
Office and washhouse		267,000
Shop and warehouse		615,000
Oil and storage facilities		43,000
Initial road construction		214,000
Site preparation		133,000
Exploration		213,000
Environmental study		450,000
Silo and unit train loading facilities		5,225,000
Total direct		51,550,000
Field indirect		1,031,000
Total construction		52,581,000
Engineering		1,052,000
Overhead and administration		2,629,000
		56,262,000

TABLE C-1. - Capital investment summary, 5-MMtpy mine - Continued

Item	Quantity	Total cost
Carried forward.....		56,262,000
Contingency.....		8,439,000
		64,701,000
Fee.....		1,294,000
		65,995,000
Interest during development.....		3,300,000
Net estimate.....		69,295,000

TABLE C-2. - Manning, 5-MMtpy mine

Personnel	Total	Wages[1] per day	Cost per year	Cost per ton
Topsoil and reclamation:				
Wheel tractor scraper operator..	12	87.36	233,272	
Bulldozer operator.....	12	87.36	233,272	
	24		466,544	$0.09
Overburden removal:				
Bulldozer operator[2].....	3	87.36	111,921	
Dragline operator[2].....	3	92.48	118,374	
Dragline oiler[2].....	3	87.36	111,921	
Dragline groundman[2].....	3	87.36	111,921	
Dragline mechanic[2].....	3	89.84	115,021	
	15		569,158	.12
Coal removal and loading:				
Shovel operator.....	2	92.48	41,132	
Shovel oiler.....	2	87.36	38,878	
Front-end loader.....	2	87.36	38,878	
Driller.....	4	83.92	74,730	
Driller helper.....	4	79.12	70,506	
Shooter.....	2	83.92	36,924	
Shooter helper.....	2	79.12	34,812	
Pitman.....	12	79.12	211,518	
	30		547,378	.11
Coal haulage, truck driver.....	12	83.92	224,188	.05
Maintenance:				
Road grader operator.....	4	87.36	77,756	
Water truck driver.....	4	79.12	70,504	
Fuel truck driver.....	2	79.12	35,252	
Lubrication truck driver.....	3	79.12	53,186	
Supply truck driver.....	2	79.12	35,252	
Mechanic.....	16	89.84	322,221	
Electrician.....	10	89.84	201,080	
Welder.....	10	89.84	201,080	
	51		996,331	.20
Utility, utilityman.....	15	79.12	265,320	.05
Unit train loading:				
Railroad car loader.....	2	83.92	37,364	
Beltman.....	4	79.84	71,140	
	6		108,504	.02
Salary:				
Superintendent.....	1		37,500	
General pit foreman.....	1		25,500	
Pit foreman.....	3		61,500	
Maintenance superintendent.....	1		28,000	
Maintenance foreman.....	3		61,500	
Mining engineer.....	1		29,000	
Geologist.....	1		21,500	
Environmental specialist.....	1		19,500	
Safety inspector.....	3		57,000	
Office manager.....	1		20,500	

TABLE C-2. - Manning, 5-MMtpy mine - Continued

Personnel	Total	Wages[1] per day	Cost per year	Cost per ton
Purchasing agent.	1		20,500	
Timekeeper.	1		14,000	
Bookkeeper.	1		14,000	
Warehouseman.	3		39,000	
	22		449,000	.09
Total labor and supervision	175		3,626,400	.73

[1]Figures in this column are for the day shift. Shift differentials for other shifts are reflected in the final column. Wages are those established in the Western Surface Coal Mine Agreement of 1977.

[2]345 days per year. All other personnel 220 days per year.

TABLE C-3. - Depreciation schedule, 5-MMtpy mine

Item	Straight-line depreciation, years	Yearly charge, dollars
Topsoil removal and reclamation:		
Wheel tractor scraper	5	211,800
Bulldozer	7	152,600
Overburden removal:		
Dragline	20	1,599,000
Cable handler and reel	20	4,200
Bulldozer	3	89,000
Coal removal and loading:		
Coal loading shovel	20	116,600
Front-end loader	5	61,500
Coal drill	10	10,700
Explosive truck	5	2,200
Coal haulage, truck	7	579,200
Maintenance equipment:		
Road grader	7	44,400
Water truck	10	11,200
Lubrication truck	10	5,200
Fuel truck	10	1,500
Mechanic truck	5	11,400
Welding truck	5	9,400
Electrician truck	5	5,400
Supply truck	5	3,400
Pickup truck	3	15,300
Crane truck	10	12,000
Auxiliary:		
Pump (portable)	10	1,600
Floodlights and towers	10	2,100
Communication	10	2,100
Power setup	20	35,100
Cable	5	149,400
Explosive storage facilities	20	1,400
Office and washhouse	20	13,400
Shop and warehouse	20	30,800
Oil and fuel storage	20	2,200
Initial road construction	20	10,700
Site preparation	20	6,700
Exploration	20	10,700
Environmental study	20	22,500
Silo and unit train loading facilities	20	261,300
Interim equipment replacement	20	300,000
		3,796,000
Depreciation for field indirect, engineering, overhead and administration, contingency, fee, and interest during development	20	887,300
Total		[1]4,683,300

[1]$0.94 per ton.

NOTE:--Rubber-tired vehicles reflect depreciation excluding tires, which are shown as an operating expense.

TABLE C-4. - Estimated annual operating cost, 5-MMtpy mine

Item	Annual cost	Cost per ton
Direct cost:		
Production:		
Labor	$2,181,100	$0.44
Supervision	359,500	.07
	2,540,600	.51
Maintenance:		
Labor	996,300	.20
Supervision	89,500	.02
	1,085,800	.22
Total labor and supervision	3,626,400	.73
Operating supplies:		
Spare parts	2,118,000	.42
Fuel, oil, and lubrication	699,000	.14
Drill bits	160,000	.03
Tires	571,000	.12
Explosives	288,000	.06
Miscellaneous	706,000	.14
	4,542,000	.91
Electricity	1,603,000	.32
Contracted for discing, mulching, liming, fertilizer, and seeding	1,000,000	.20
Payroll overhead (40 percent of payroll)	1,450,600	.29
Pension and welfare plans	782,100	.16
Royalty (12.5 percent of selling price)[1]	5,619,700	1.12
Severance tax	4,150,000	.83
Strip license	1,000	
Federal reclamation fund	500,000	.10
Indirect cost (15 percent of labor, maintenance, and supplies)	1,225,300	.24
Fixed cost:		
Taxes and insurance, 3 percent of mine cost)	1,979,900	.39
Depreciation	4,683,300	.94
	6,663,200	1.33
Total	31,163,300	6.23

[1]15 percent discounted cash flow rate of return, 100 percent equity.

TABLE C-5. - Working capital and total capital investment, 5-MMtpy mine

Estimated working capital:		
Direct labor	3 months	$906,600
Operating supplies	do	1,135,500
Payroll overhead	do	362,700
Indirect cost	4 months	408,400
Fixed cost	5% of insurance base	330,000
Strip bond		490,500
Spare parts		577,200
Miscellaneous		64,100
Total working capital		4,275,000
Total estimated capital investment:		
Total plant		65,995,000
Interest during development		3,300,000
Subtotal		69,295,000
Working capital		4,275,000
Estimated initial capital investment		73,570,000
Estimated deferred capital investment		27,750,000
Total capital and deferred investment		[1]101,320,000

[1]This is an average cost of $20.26 per ton of annual production.

TABLE C-6. - Discounted cash flow summary and analysis, 100% equity, 5-MMtpy mine
(Costs, except per-ton selling price, are shown in thousands of dollars)

Year	Capital investment	Net cash flow[1]	Present worth factor at 15%	Present worth capital investment at 15%	Present worth cash flow at 15%	Annual production M tons	Selling price, dollars per ton	Annual sales	Operating cost[2]	Gross profit	Depletion	Taxable income	Federal income tax	Net profit
-1	36,785.0	-36,785.0	1.1500	42,302.8	-42,302.8									
0	36,785.0	-36,785.0	1.0000	36,785.0	-36,785.0									
1	300.0	13,528.4	.8696	260.9	11,764.3	5,000	8.99	44,957.8	31,163.3	13,794.5	4,495.8	9,298.7	4,649.4	4,649.3
2	300.0	13,528.4	.7561	226.8	10,228.8	5,000	8.99	44,957.8	31,163.3	13,794.5	4,495.8	9,298.7	4,649.4	4,649.3
3	615.0	13,213.4	.6575	404.4	8,687.8	5,000	8.99	44,957.8	31,163.3	13,794.5	4,495.8	9,298.7	4,649.4	4,649.3
4	300.0	13,528.4	.5718	171.5	7,735.5	5,000	8.99	44,957.8	31,163.3	13,794.5	4,495.8	9,298.7	4,649.4	4,649.3
5	2,741.0	11,087.4	.4972	1,362.8	5,512.7	5,000	8.99	44,957.8	31,163.3	13,794.5	4,495.8	9,298.7	4,649.4	4,649.3
6	615.0	13,213.4	.4323	265.9	5,712.2	5,000	8.99	44,957.8	31,163.3	13,794.5	4,495.8	9,298.7	4,649.4	4,649.3
7	6,328.0	7,500.4	.3759	2,378.9	2,819.4	5,000	8.99	44,957.8	31,163.3	13,794.5	4,495.8	9,298.7	4,649.4	4,649.3
8	300.0	13,528.4	.3269	98.1	4,422.4	5,000	8.99	44,957.8	31,163.3	13,794.5	4,495.8	9,298.7	4,649.4	4,649.3
9	615.0	13,213.4	.2843	174.8	3,756.6	5,000	8.99	44,957.8	31,163.3	13,794.5	4,495.8	9,298.7	4,649.4	4,649.3
10	3,222.0	10,606.4	.2472	796.4	2,621.9	5,000	8.99	44,957.8	31,163.3	13,794.5	4,495.8	9,298.7	4,649.4	4,649.3
11	300.0	13,528.4	.2149	64.5	2,907.3	5,000	8.99	44,957.8	31,163.3	13,794.5	4,495.8	9,298.7	4,649.4	4,649.3
12	615.0	13,213.4	.1869	114.9	2,469.6	5,000	8.99	44,957.8	31,163.3	13,794.5	4,495.8	9,298.7	4,649.4	4,649.3
13	300.0	13,528.4	.1625	48.8	2,198.4	5,000	8.99	44,957.8	31,163.3	13,794.5	4,495.8	9,298.7	4,649.4	4,649.3
14	6,328.0	7,500.4	.1413	894.3	1,059.8	5,000	8.99	44,957.8	31,163.3	13,794.5	4,495.8	9,298.7	4,649.4	4,649.3
15	3,056.0	10,772.4	.1229	375.6	1,323.9	5,000	8.99	44,957.8	31,163.3	13,794.5	4,495.8	9,298.7	4,649.4	4,649.3
16	300.0	13,528.4	.1069	32.1	1,446.2	5,000	8.99	44,957.8	31,163.3	13,794.5	4,495.8	9,298.7	4,649.4	4,649.3
17	300.0	13,528.4	.0929	27.9	1,256.8	5,000	8.99	44,957.8	31,163.3	13,794.5	4,495.8	9,298.7	4,649.4	4,649.3
18	615.0	13,213.4	.0808	49.7	1,067.6	5,000	8.99	44,957.8	31,163.3	13,794.5	4,495.8	9,298.7	4,649.4	4,649.3
19	300.0	13,528.4	.0703	21.1	951.0	5,000	8.99	44,957.8	31,163.3	13,794.5	4,495.8	9,298.7	4,649.4	4,649.3
20	-4,941.1	18,769.5	.0611	-301.9	1,146.8	5,000	8.99	44,957.8	31,163.3	13,794.5	4,495.8	9,298.7	4,649.4	4,649.3
				86,555.3	1.2									

[1]Net cash flow is depreciation + depletion + net profit - capital investment.
[2]Includes $5,619,700 royalty; $1.12 per ton.

TABLE C-7. - Discounted cash flow summary and analysis, debt-equity split of 1:2, 5-MMtpy mine
(Costs, except per-ton selling price, are shown in thousands of dollars)

Year	Capital investment	Debt	Equity	Present worth factor at 15%	Debt plus accrued interest	Present worth equity at 15%	Net annual cash flow[1]	Present worth of net cash flow at 15%	Annual interest payment at 9%	Annual principal repayment	Annual production M tons	Annual sales	Selling price, dollars per ton	Operating cost[2]	Gross profit	Depletion	Taxable income	Federal income tax	Profit	Net profit
-1	36,785.0	12,139.1	24,645.9	1.1500	13,231.6	28,342.8	-24,645.9	-28,342.8												
0	36,785.0	12,139.1	24,645.9	1.0000	12,139.1	24,645.9	-24,645.9	-24,645.9												
1	300.0			.8696		260.9	9,476.9	8,241.1	2,283.3	495.9	5,000	40,319.5	8.06	32,866.8	7,452.7	3,726.3	3,726.4	1,863.2	1,863.2	1,367.3
2	300.0			.7561		226.8	9,465.8	7,157.1	2,238.7	540.5	5,000	40,319.5	8.06	32,822.2	7,497.3	3,748.7	3,748.6	1,874.3	1,874.3	1,333.8
3	615.0			.6575		404.4	9,138.6	6,008.6	2,190.0	589.2	5,000	40,319.5	8.06	32,773.5	7,546.0	3,773.0	3,773.0	1,886.5	1,886.5	1,297.3
4	300.0			.5718		171.5	9,440.3	5,398.0	2,137.0	642.2	5,000	40,319.5	8.06	32,720.5	7,599.0	3,799.5	3,799.5	1,899.8	1,899.7	1,257.5
5	2,741.0			.4972		1,362.8	6,984.9	3,472.9	2,079.2	700.0	5,000	40,319.5	8.06	32,662.7	7,656.8	3,828.4	3,828.4	1,914.2	1,914.2	1,214.2
6	615.0			.4323		265.9	9,095.1	3,931.8	2,016.2	763.0	5,000	40,319.5	8.06	32,599.7	7,719.8	3,859.9	3,859.9	1,930.0	1,929.9	1,166.9
7	6,328.0			.3759		2,378.9	3,365.0	1,264.9	1,947.5	831.7	5,000	40,319.5	8.06	32,531.0	7,788.5	3,894.3	3,894.2	1,947.1	1,947.1	1,115.4
8	300.0			.3269		98.1	9,374.3	3,064.5	1,872.7	906.5	5,000	40,319.5	8.06	32,456.2	7,863.3	3,931.7	3,931.6	1,965.8	1,965.8	1,059.3
9	615.0			.2843		174.8	9,038.9	2,569.8	1,791.1	988.1	5.000	40,319.5	8.06	32,374.6	7,944.9	3,972.5	3,972.4	1,986.2	1,986.2	998.1
10	3,222.0			.2472		796.4	6,409.6	1,584.5	1,702.2	1,077.0	5,000	40,319.5	8.06	32,285.7	8,033.8	4,016.9	4,016.9	2,008.5	2,008.4	931.4
11	300.0			.2149		64.5	9,290.9	1,996.6	1,605.2	1,174.0	5,000	40,319.5	8.06	32,188.7	8,130.8	4,032.0	4,099.2	2,049.6	2,049.6	875.6
12	615.0			.1869		114.9	8,922.9	1,667.7	1,499.6	1,279.6	5,000	40,319.5	8.06	32,083.1	8,236.4	4,032.0	4,204.4	2,102.2	2,102.2	822.6
13	300.0			.1625		48.8	9,180.3	1,491.8	1,384.4	1,394.8	5,000	40,319.5	8.06	31,967.9	8,351.6	4,032.0	4,319.6	2,159.8	2,159.8	765.0
14	6,328.0			.1413		894.3	3,089.5	436.5	1,258.9	1,520.3	5,000	40,319.5	8.06	31,842.4	8,477.1	4,032.0	4,445.1	2,222.6	2,222.5	702.2
15	3,056.0			.1229		375.6	6,293.1	773.4	1,122.0	1,657.2	5,000	40,319.5	8.06	31,705.5	8,614.0	4,032.0	4,582.0	2,291.0	2,291.0	633.8
16	300.0			.1069		32.1	8,974.5	959.4	972.9	1,806.3	5,000	40,319.5	8.06	31,556.4	8,763.1	4,032.0	4,731.1	2,365.6	2,365.5	559.2
17	300.0			.0929		27.9	8,893.2	826.2	810.3	1,968.9	5,000	40,319.5	8.06	31,393.8	8,925.7	4,032.0	4,893.7	2,446.9	2,446.8	477.9
18	615.0			.0808		49.7	8,489.6	686.0	633.1	2,146.1	5,000	40,319.5	8.06	31,216.6	9,102.9	4,032.0	5,070.9	2,535.5	2,535.4	389.3
19	300.0			.0703		21.1	8,708.1	612.2	440.0	2,339.2	5,000	40,319.5	8.06	31,023.5	9,296.0	4,032.0	5,264.0	2,632.0	2,632.0	292.8
20	-4,941.1			.0611		-301.9	13,843.9	845.9	229.4	2,549.8	5,000	40,319.5	8.06	30,812.9	9,506.6	4,032.0	5,474.6	2,737.3	2,737.3	187.5
						60,456.2		.2												

[1]Net cash flow is depreciation + depletion + net profit - captial investment.
[2]Includes $5,039,900 royalty; $1.01 per hour.

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