

## 6.1. MINERAL PROCESSING--CAPITAL COSTS

## 6.1.10. INFRASTRUCTURE

6.1.10.1.1. ACCESS ROADS  
CLEARING

The total cost per kilometer is the sum of two separate cost curves (labor and equipment operation) having a roadway width (X), in meters. The curves are valid for widths between 3 and 30 m, operating one shift per day. This cost is multiplied by the total kilometers to obtain the capital cost. Each curve includes all of the daily operating and maintenance costs associated with clearing for access roads. Supplies have not been considered in the clearing costs because it is assumed that cleared brush or timber would be buried under the excavation waste; thus, supplies of fuel oil for burning the clearing slash are not required.

## BASE CURVE

The curves are based on estimated costs for clearing medium growth on terrain with a side slope of 25%. Medium growth varies from heavy brush to one tree, 0.33 m in diameter, per 40 m<sup>2</sup>.

(L) Labor Operating Cost  $(Y_L) = 1,135.467(X)^{0.711}$

The operating labor costs are distributed as follows:

Direct labor.....	86%
Maintenance labor.....	14%

The direct labor costs consist of the following typical range of personnel:

		Av salary per hour (base rate)
Dozer operator.....	12%	\$16.33
Wheel-loader operator.....	12%	16.33
Flatbed-truck driver.....	12%	15.89
General laborer.....	64%	13.86

The average wage for labor is \$14.63 per worker-hour (including burden and average shift differential).

(E) Equipment Operating Cost  $(Y_E) = 467.945(X)^{0.711}$

The equipment operating cost consists of 35% for repair parts, 53% for fuel and lubrication, and 12% for tires.

The equipment operating cost consists of:

Dozer crawler.....	31%
Wheel loader.....	47%
Flatbed truck.....	12%
Pickup truck.....	9%
Chainsaws.....	1%

The equipment operating cost distribution is

	<u>Repair parts</u>	<u>Fuel and lube</u>	<u>Tires</u>
Dozer crawler.....	52%	48%	-
Wheel loader.....	36%	43%	21%
Flatbed truck.....	9%	80%	11%
Pickup truck.....	8%	90%	2%
Chainsaws.....	39%	61%	-

#### ADJUSTMENT FACTORS

Brush Factor For light clearing conditions where the growth consists mainly of brush and small trees, multiply the curves by the following factors:

$$\text{Brush factor } (F_B \text{ LIGHT}) = 0.25$$

For heavy clearing conditions, defined as when clearing a dense growth of trees (diameter of the trees commonly exceeding 0.33 m), multiply the curves by the following factor:

$$\text{Brush factor } (F_B \text{ DENSE}) = 1.75$$

Side Slope Factor For clearing on terrain with side slopes other than 20% to 30% multiply the curves by the following factors:

For clearing on terrain with side slopes of 0% to 20%,

$$\text{Side slope factor } (F_S \text{ 0\%-20\%}) = 0.8$$

For clearing on terrain with side slopes of 30% to 50%,

$$\text{Side slope factor } (F_S \text{ 30\%-50\%}) = 1.8$$

For clearing on terrain with side slopes of 50% to 100%,

$$\text{Side slope factor } (F_S \text{ 50\%-100\%}) = 2.5$$

Burning Equation If fuel oil (for burning slash) or other supplies, such as cables and chokers, are used, add the following supply cost equation to the total cost per kilometer. The total cost per kilometer for supplies is for a roadway of width (X), in meters, varying in width from 3 to 30 m.

$$(S) \text{ Supply Operating Cost } (Y_S \text{ BURNING}) = 269.796[0.100(X)] - 0.0303$$

This cost is multiplied by the total kilometers, valid for values between 3.33 to 3,333.33 km, to obtain the capital cost.

For clearing operations from 1 to 500 ha (roadway width in meters multiplied by roadway length in meters multiplied by 0.0001), the supplies consist of 78% for fuel oil and 22% for tools, cables, and chokers. For clearing operations of 500 to 1,000 hectares, supplies consist of 83% for fuel oil (for burning wood and scrub) and 17% for tools, cables, and chokers.

Equipment Factor Where it is necessary to purchase equipment, or have a subcontractor perform the work, multiply the equipment operation value by the following applicable factor in order to obtain the total value of equipment expense for ownership and operation:

Shifts per day.....	1	2	3
Factor.....	1.91	1.68	1.61

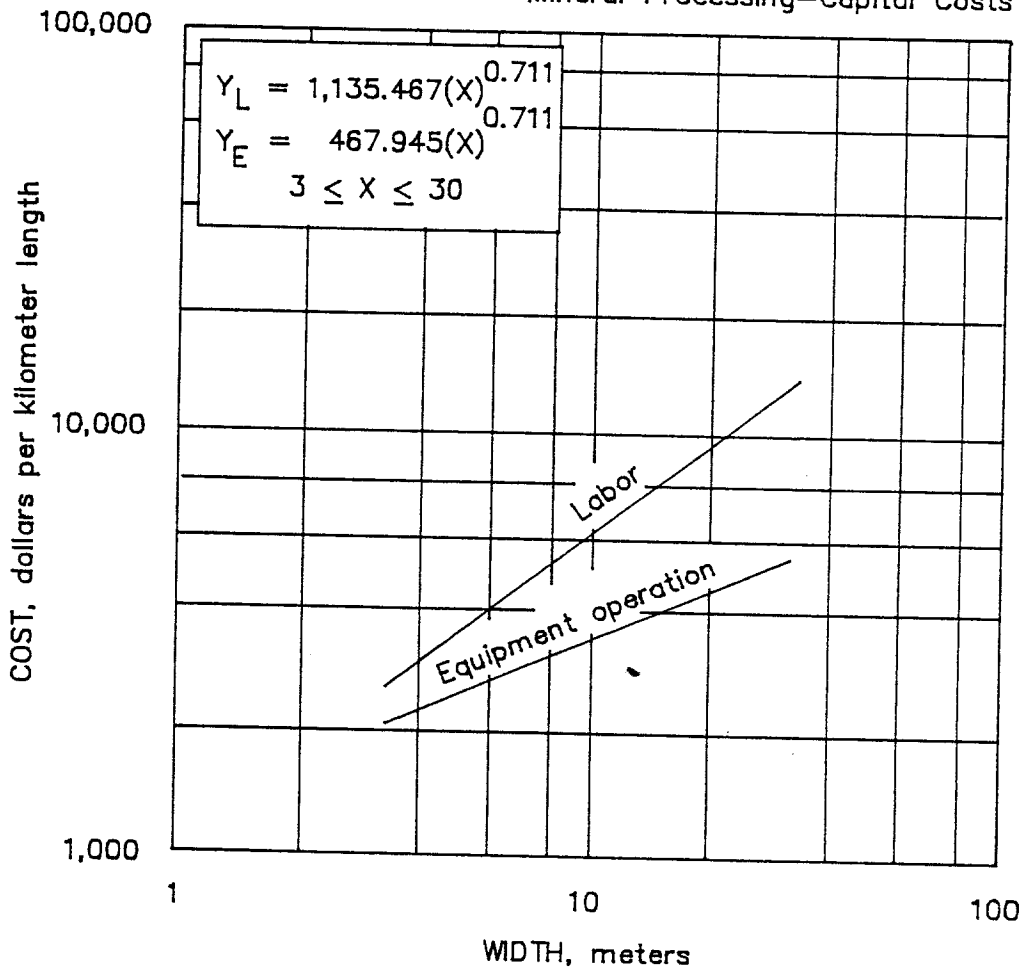
Subcontractor Factor If a subcontractor is used multiply the costs obtained from the curve by the following factors, to compensate for the subcontractor's mark-up:

Labor factor  $(F_L) = 1.5$

Supply factor  $(F_S) = 1.2$

Equipment operation factor  $(F_E) = 1.2$

Mineral Processing—Capital Costs



6.1.10.1.1. Access road  
CLEARING

6.1. MINERAL PROCESSING--CAPITAL COSTS

6.1.10. INFRASTRUCTURE

6.1.10.1.2. ACCESS ROADS  
DRILL AND BLAST

The total cost per kilometer is the sum of three separate cost curves (labor, supplies, and equipment operation) having a roadway width (X), in meters. The curves are valid for widths between 3 and 30 m, operating one shift per day. This cost is multiplied by the total kilometers to obtain the capital cost. Each curve includes all of the daily operating and maintenance costs associated with drilling and blasting for access roads.

BASE CURVE

The curves are based on estimated costs for drilling and blasting a cut with a single ditch. The terrain has a side slope of 0% to 20%, and the cut contains 50% rock.

(L) Labor Operating Cost  $(Y_L) = 9,633.822(X)^{0.496}$

The operating labor costs are distributed as follows:

Direct labor.....	79%
Maintenance labor.....	21%

The direct labor costs consist of the following typical range of personnel:

		Av salary per hour (base rate)
Air-track driller.....	33%	\$16.78
Compressor operator.....	17%	17.23
Chuck tender.....	27%	13.86
Powderman.....	8%	16.33
Powderman helper.....	7%	14.56
Flatbed-truck driver.....	8%	15.89

The average wage for labor is \$15.68 per worker-hour (including burden and average shift differential).

(S) Supply Operating Cost  $(Y_S) = 7,247.524(X)^{0.644}$

The supply cost consists of 79% blasting supplies and 21% drilling supplies. Drilling supplies consist of percussion drill bits, rods, striking bars, and couplings; blasting supplies consist of dynamite, ANFO, electric blasting caps, and connecting wire.

(E) Equipment Operating Cost  $(Y_E) = 4,109.384(X)^{0.496}$

The equipment operating cost consists of 51% for repair parts, 48% for fuel and lubrication, and 1% for tires.

The equipment operation curve consists of:

Air-track drills.....	33%
Portable compressors.....	55%
Flatbed truck.....	7%
Pickup truck.....	5%

The equipment operating cost distribution is

	<u>Repair parts</u>	<u>Fuel and lube</u>	<u>Tires</u>
Air-track drills.....	93%	7%	-
Portable compressors.....	34%	65%	1%
Flatbed truck.....	9%	80%	11%
Pickup truck.....	8%	90%	2%

ADJUSTMENT FACTORS

Rock Factor For drilling and blasting cuts that contain other than 50% rock, multiply the costs obtained from the curves by the following factors:

For drilling and blasting cuts containing 25% rock,

$$\text{Rock factor } (F_R \text{ 25\%}) = 0.6$$

For drilling and blasting cuts containing 100% rock,

$$\text{Rock factor } (F_R \text{ 100\%}) = 1.4$$

Side Slope Factor For terrain with side slopes other than 0% to 20% multiply the cost obtained from the curves by the following factors:

For clearing on terrain with side slopes of 20% to 50%,

$$\text{Side slope factor } (F_S \text{ 20\%-50\%}) = 1.5$$

On terrain with side slopes in the range of 50% to 100%,

$$\text{Side slope factor } (F_S \text{ 50\%-100\%}) = 3.0$$

Equipment Factor Where it is necessary to purchase equipment, or have a subcontractor perform the work, multiply the equipment operation value by the following applicable factor in order to obtain the total value of equipment expense for ownership and operation:

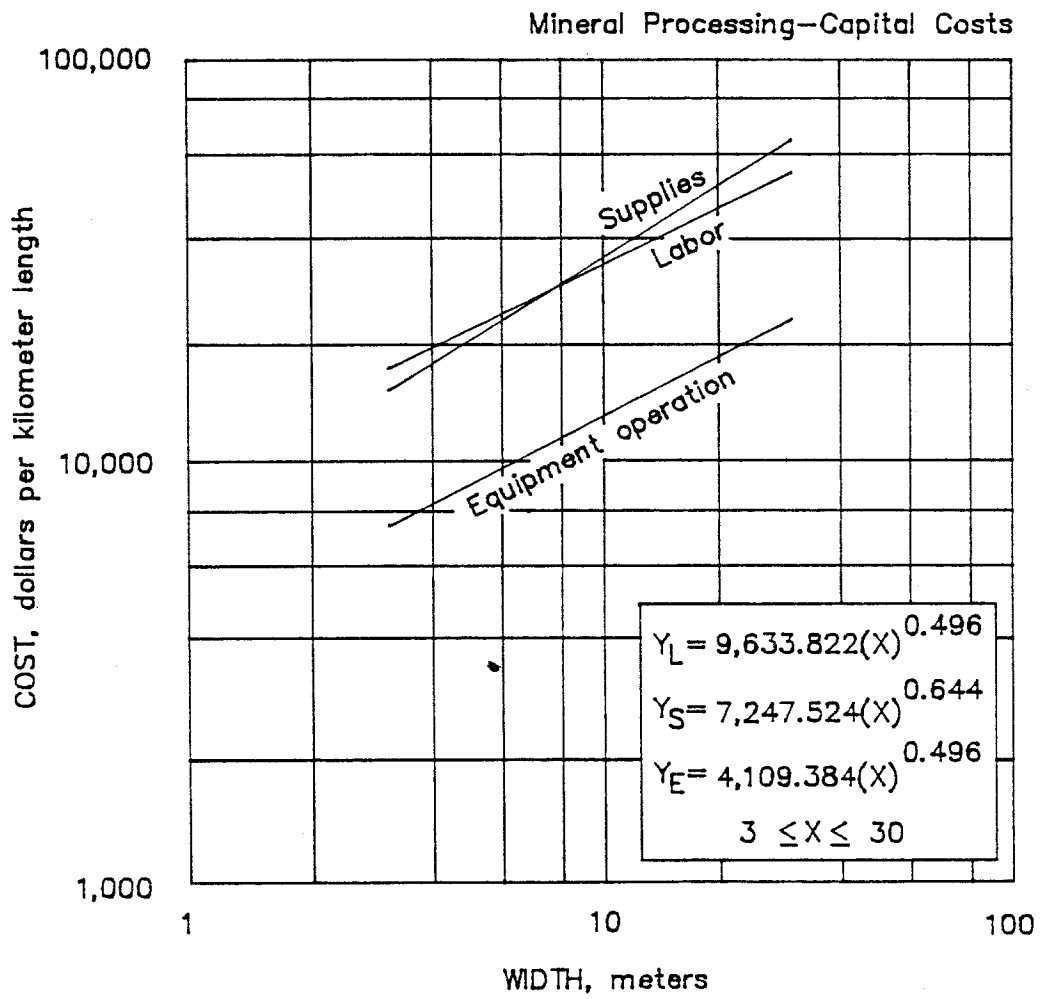
Shifts per day.....	1	2	3
Factor.....	2.12	1.84	1.75

Subcontractor Factor If a subcontractor is used, to compensate for the subcontractor's markup, multiply the costs by the following factors:

$$\text{Labor factor } (F_L) = 1.5$$

$$\text{Supply factor } (F_S) = 1.2$$

$$\text{Equipment operation factor } (F_E) = 1.2$$



6.1.10.1.2. Access roads  
DRILL AND BLAST

## 6.1. MINERAL PROCESSING--CAPITAL COSTS

## 6.1.10. INFRASTRUCTURE

6.1.10.1.3. ACCESS ROADS  
EXCAVATION

The total cost per kilometer is the sum of two separate cost curves (labor and equipment operation) having a roadway width (X), in meters. The curves are valid for widths between 3 and 30 m, operating one shift per day. This cost is multiplied by the total kilometers to obtain the capital cost. Each curve includes all of the daily operating and maintenance costs associated with excavation for access roads.

## BASE CURVES

The curves are based on a dozer excavation operation that is working on terrain with a side slope of 25%, side-casting from cuts or ditches to a 30-cm fill or to waste. The material to be excavated is either blasted rock or a common conglomerate that presents some difficulty in cutting and drifting.

(L) Labor Operating Cost  $(Y_L) = 29.843(X)^{1.870}$

The operating labor costs are distributed as follows:

Direct labor.....	60%
Maintenance labor.....	40%

The direct labor costs consist of the following typical range of personnel:

		Av salary per hour (base rate)
Dozer operator.....	60%	\$16.33
Grader operator.....	20%	16.33
Water-truck driver.....	20%	15.89

The average wage for labor is \$16.24 per worker-hour (including burden and average shift differential).

(E) Equipment Operating Cost  $(Y_E) = 27.128(X)^{1.870}$

The equipment operating cost consists of 46% for repair parts, 50% for fuel and lubrication, and 4% for tires.

The equipment operation curve consists of:

Dozer crawlers.....	47%
Dozer-ripper crawler.....	25%
Motor grader.....	15%
Water truck.....	9%
Pickup truck.....	4%

The equipment operating cost distribution is

	<u>Repair parts</u>	<u>Fuel and lube</u>	<u>Tires</u>
Dozer crawlers.....	51%	49%	-
Dozer ripper crawler.....	53%	47%	-
Motor grader.....	45%	41%	14%
Water truck.....	29%	55%	16%
Pickup truck.....	8%	90%	2%

#### ADJUSTMENT FACTORS

Side Slope Factor On terrain with a side slope other than 20% to 30%, multiply the costs obtained from the curves by the following factors:

For clearing on terrain with side slopes of 0% to 20%,

Side slope factor ( $F_S$  0%-20%) =  $[0.8(S)]0.600(W)^{0.756}$   
 where S = side slope [defined as  $1 + (\text{percent slope}/100)$ ],  
 and W = roadway width, in meters.

For clearing on terrain with side slopes of 30% to 100%,

Side slope factor ( $F_S$  30%-100%) =  $[0.8(S)]3.958(W)^{0.087}$   
 where S = side slope [defined as  $1 + (\text{percent slope}/100)$ ],  
 and W = roadway width, in meters.

Material Factor For excavation of materials that are easy to cut and drift, multiply the costs obtained from the curves by the following factor:

Material factor ( $F_M$  EASY) = 0.75

For excavation of extremely wet and sticky material, multiply the costs obtained from the curves by the following factor:

Material factor ( $F_M$  DIFFICULT) = 1.33

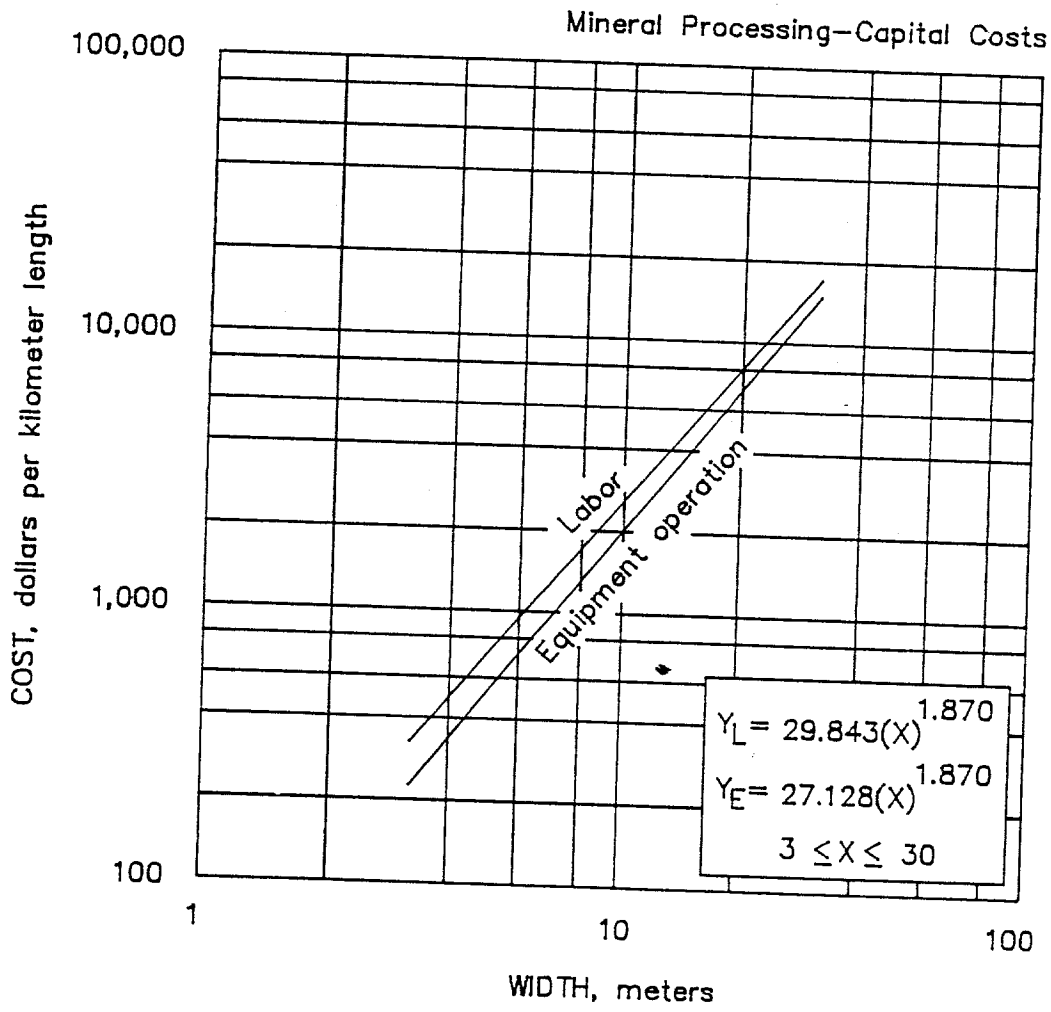
Equipment Factor Where it is necessary to purchase equipment, or have a subcontractor perform the work, multiply the equipment operation cost obtained from the curve by the following applicable factor in order to obtain the total value of equipment expense for ownership and operation:

Shifts per day.....	1	2	3
Factor.....	1.94	1.71	1.63

Subcontractor Factor If a subcontractor is used, to compensate for the subcontractor's markup, multiply the costs obtained from the curves by the following factors:

Labor factor ( $F_L$ ) = 1.5

Equipment operation factor ( $F_E$ ) = 1.2



6.1.10.1.3. Access roads  
EXCAVATION

## 6.1. MINERAL PROCESSING--CAPITAL COSTS

## 6.1.10. INFRASTRUCTURE

6.1.10.1.4. ACCESS ROADS  
GRAVEL SURFACING

The total cost per kilometer is the sum of three separate cost curves (labor, supplies, and equipment operation) having a roadway width (X), in meters. The curves are valid for widths between 3 and 30 m, operating one shift per day. This cost is multiplied by the total kilometers to obtain the capital cost. Each curve includes all of the daily operating and maintenance costs associated with gravel surfacing of access roads.

## BASE CURVE

The curves are based on costs for preparing a road subbase, spreading surfacing material on the roadway, and compacting the surfacing material to a depth of 0.20 m. The surfacing material is delivered to the jobsite in suppliers' trucks.

(L) Labor Operating Cost  $(Y_L) = 293.304(X)^{0.667}$

The operating labor costs are distributed as follows:

Direct labor.....	83%
Maintenance labor.....	17%

The direct labor costs consist of the following typical range of personnel:

		Av salary per hour (base rate)
Grader operator.....	21%	\$16.33
Roller operator.....	21%	16.33
Dumpman.....	18%	13.86
Grade checker.....	20%	15.89
Water-truck driver.....	20%	15.89

The average wage for labor is \$15.66 per worker-hour (including burden and average shift differential).

(S) Supply Operating Cost  $(Y_S) = 6,880.012(X)^{1.006}$

The supply cost consists of 100% minus 1.9-cm road-surfacing gravel. The gravel, delivered and dumped on the roadbed by suppliers' trucks, costs \$13.76 per metric ton.

(E) Equipment Operating Cost  $(Y_E) = 135.032(X)^{0.667}$

The equipment operating cost consists of 37% for repair parts, 51% for fuel and lubrication, and 12% for tires.

The equipment operation curve consists of:

Motor grader.....	42%
Rubber-tired, self-propelled roller.....	19%
Water truck.....	26%
Pickup truck.....	13%

The equipment operating cost distribution is

	<u>Repair parts</u>	<u>Fuel and lube</u>	<u>Tires</u>
Motor grader.....	45%	41%	14%
Rubber-tired, self-propelled roller.....	49%	40%	11%
Water truck.....	29%	55%	16%
Pickup truck.....	8%	90%	2%

ADJUSTMENT FACTORS

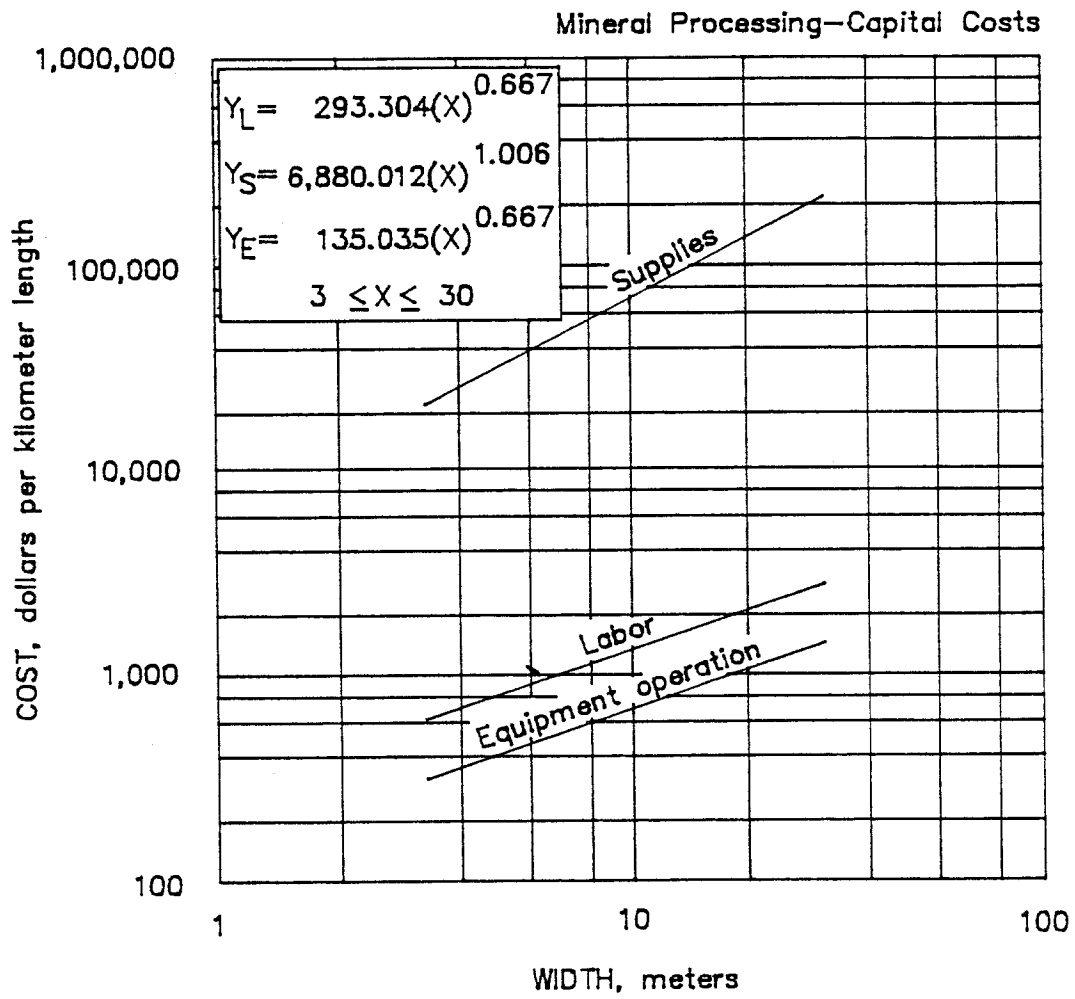
Equipment Factor Where it is necessary to purchase equipment, or have a subcontractor perform the work, multiply the equipment operation cost obtained from the curve by the following applicable factor in order to obtain the total value of equipment expense for ownership and operation:

Shifts per day.....	1	2	3
Factor.....	2.05	1.79	1.70

Subcontractor Factor If a subcontractor is used multiply the costs obtained from the curves by the following factors to compensate for the subcontractor's mark-up:

- Labor factor (F<sub>L</sub>) = 1.5
- Supply factor (F<sub>S</sub>) = 1.2
- Equipment operation factor (F<sub>E</sub>) = 1.2

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6.1.10.1.4. Access roads  
GRAVEL SURFACING

## 6.1. MINERAL PROCESSING--CAPITAL COSTS

## 6.1.10. INFRASTRUCTURE

6.1.10.1.5. ACCESS ROADS  
PAVING

The total cost per kilometer is the sum of three separate cost curves (labor, supplies, and equipment operation) having a roadway width (X), in meters. The curves are valid for widths between 3 and 30 m, operating one shift per day. This cost is multiplied by the total kilometers to obtain the capital cost. Each curve includes all of the daily operating and maintenance costs associated with paving of access roads.

## BASE CURVE

The curves are based on a paving operation for laying and compacting hot-mix asphalt concrete (purchased locally from a hot-mix plant) to a depth of 5.1 cm. Costs to produce an appropriate paving road base are covered in section 6.1.10.1.4., Gravel Surfacing.

(L) Labor Operating Cost  $(Y_L) = 117.710(X)^{1.005}$

The operating labor costs are distributed as follows:

Direct labor.....	80%
Maintenance labor.....	20%

The direct labor costs consist of the following typical range of personnel:

		Av salary per hour (base rate)
Paver operator.....	13%	\$16.33
Roller operator.....	26%	16.33
General laborer.....	22%	13.86
Rear-dump truck driver.....	39%	15.89

The average wage for labor is \$15.55 per worker-hour (including burden and average shift differential).

(S) Supply Operating Cost  $(Y_S) = 2,661.382(X)^{1.005}$

The supply cost consists of 100% asphalt concrete (minus 1.9-cm hot mix). The asphalt concrete, supplied by a local hot-mix plant, costs \$26.37 per metric ton.

(E) Equipment Operating Cost  $(Y_E) = 68.436(X)^{1.005}$

The equipment operating cost consists of 32% for repair parts, 58% for fuel and lubrication, and 10% for tires.

The equipment operation curve consists of:

Asphalt paver.....	20%
Rubber-tired, self-propelled roller.....	5%
Steel-wheeled, tandem roller.....	5%
Rear-dump trucks.....	64%
Pickup truck.....	6%

The equipment operating cost distribution is

	<u>Repair parts</u>	<u>Fuel and lube</u>	<u>Tires</u>
Asphalt paver.....	68%	32%	-
Rubber-tired, self-propelled roller.....	43%	51%	6%
Steel-wheeled, tandem roller.....	50%	50%	-
Rear-dump trucks.....	22%	63%	15%
Pickup truck.....	8%	90%	2%

ADJUSTMENT FACTORS

Supply Factor The supplies cost should be adjusted for changes in the base asphalt concrete price.

Equipment Factor Where it is necessary to purchase equipment, or have a subcontractor perform the work, multiply the equipment operation cost obtained from the curve by the following applicable factor in order to obtain the total value of equipment expense for ownership and operation:

Shifts per day.....	1	2	3
Factor.....	1.44	1.33	1.29

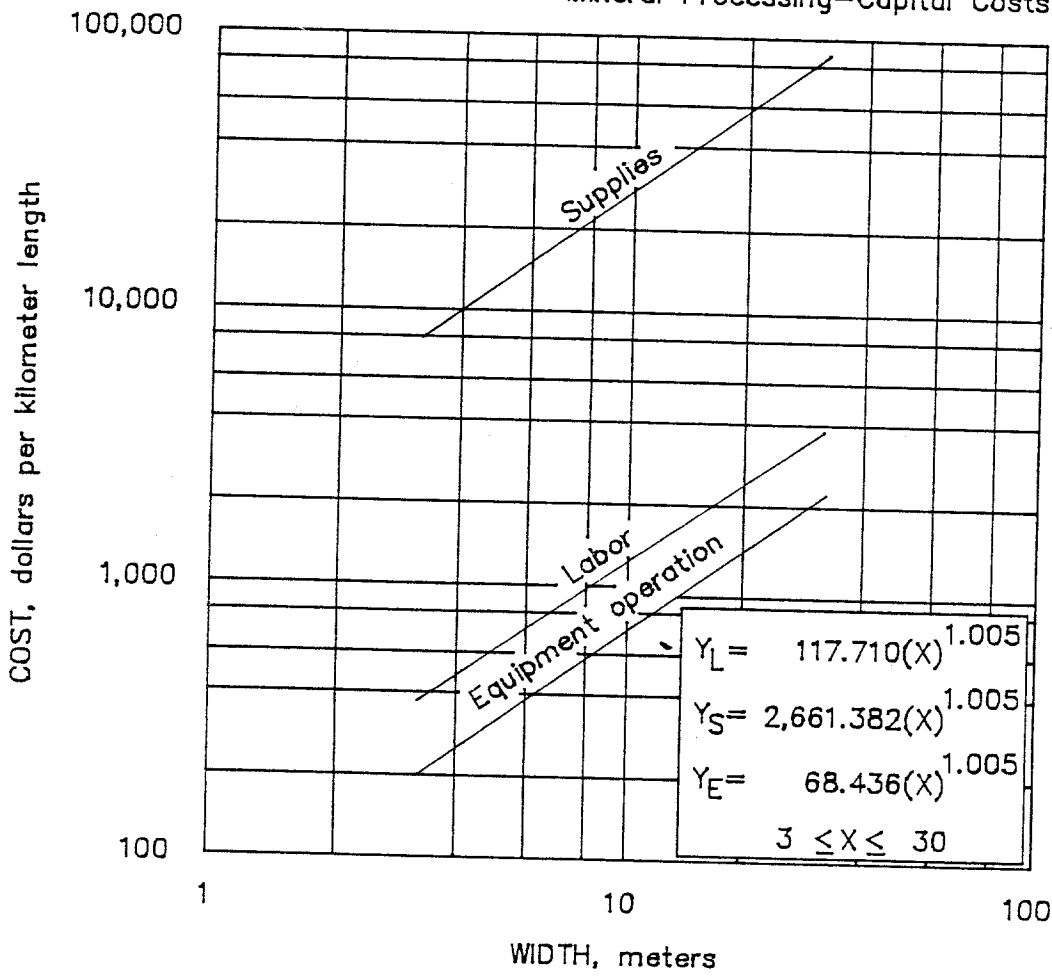
Subcontractor Factor If a subcontractor is used multiply the costs obtained from the curves by the following factors to compensate for the subcontractor's mark-up:

Labor factor (F<sub>L</sub>) = 1.5

Supply factor (F<sub>S</sub>) = 1.2

Equipment operation factor (F<sub>E</sub>) = 1.2

### Mineral Processing—Capital Costs



6.1.10.1.5. Access roads  
PAVING

## 6.1. MINERAL PROCESSING--CAPITAL COSTS

## 6.1.10. INFRASTRUCTURE

## 6.1.10.2. TOWNSITE

The following housing costs are for a typical average quality park based on using trailers or manufactured mobile home housing containing between 150 and 200 units. Costs are quoted per individual housing unit. Costs are factored by using the Bureau of Labor Statistics Industrial Materials Cost Index. Site costs do not include land-site acquisition, construction of utility trunk lines to the site, or a waste water treatment plant. Waste water disposal uses a septic tank and drain field; however, transportation and setup costs to areas within 100 miles of Denver, CO, are included.

## Typical average site costs for family or bachelor unit

	Family	Bachelor
Site preparation (typical avg. area 410 m <sup>2</sup> ).....	\$1,050	\$320
Streets (7.9- to 9.8-m wide, 7.6-cm asphalt or 7.5-cm gravel edged or curbed).....	810	270
Patios and walks.....	610	200
Septic tank, includes drain field.....	1,360	750
Water, connected to unit.....	550	550
Gas, low-pressure, connected.....	310	310
Electrical, 80- to 150-A connected service to each unit.....	890	890
Office, recreation, laundry.....	1,250	1,250
Total.....	6,830	4,540

The following adjustment factors should be applied to the total typical average site cost where either quality or quantity differs.

<u>Description</u>	<u>Quality factor</u>	<u>Quantity</u>	<u>Factor</u>
Low quality (300 m <sup>2</sup> /space)	0.70	40- 80	1.07
		80-125	1.00
		150-250	0.92
Average (410 m <sup>2</sup> /space)	1.00	50-125	1.10
		150-200	1.00
		250-300	0.95
Good (520 m <sup>2</sup> /space)	1.30	50-150	1.10
		175-200	1.00
		250-350	0.97

In addition, the following accessories may also be required:

Skirting at base of trailer.....	\$620.00
Landing and steps.....	360.00
Canopies over landings.....	550.00
Air conditioning--using existing heater.....	840.00

HOUSING UNITS

Family Units--With living, dining, kitchen, bath, and sleeping facilities for two adults and two to four children. Cost is for typical average quality.

Single-wide (4.27 by 19.50m).....	\$15,400
Double-wide (7.31 by 14.63m).....	\$26,400

Quality adjustments to the single-wide, double-wide basic costs are made by multiplying the above housing unit average quality costs by the following factors:

Low quality	
Single wide.....	1.12
Double-wide.....	1.16
Average	
Single wide.....	0.90
Double-wide.....	0.87
Excellent quality	
Single wide.....	1.25
Double-wide.....	1.34

Quantity adjustments--For quantities greater than 10 units, decrease overall costs by 10%.

Snowload adjustment--For areas of heavy snowfall, increase basic unit costs 5% for increased roof support design.

Bachelor Units--Consisting of single-person motel-style rooms with a kitchen and dining room. Rooms share a centrally located restroom and shower facility. Cost is for typical average quality.

Bachelor Unit.....	\$15,000
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Number of persons adjustment--Per person cost is based on housing 400 personnel. Lodging capital costs for greater than 500 people, decrease costs by 10%. Increase costs by 15% for less than 300 and 20% for less than 200.

PRIMARY UTILITIES

Electrical, cost per linear meter:

Main overhead electric powerlines.....	\$26.32/linear m
Lateral overhead lines.....	\$8.25/linear m

Water, cost per linear meter:

Main, 15.24-cm plastic (add or deduct	
\$5.75 per 2.54-cm diam.).....	\$35.80/linear m
Lateral, 2.54 cm.....	\$17.22/linear m

## 6.1. MINERAL PROCESSING--CAPITAL COSTS

## 6.1.10. INFRASTRUCTURE

6.1.10.3.1. WASTE WATER TREATMENT  
CLARIFICATION

Clarification capital cost is for the acquisition and installation of equipment for water clarification and softening by precipitation and/or coagulation. The all metal solids-contact clarifier combines into one operation--quick mixing, flocculation, clarification, and sludge thickening. The unit will selectively or simultaneously remove turbidity, color, organic matter, manganese, iron, hardness, alkalinity, taste, and odor.

## BASE CURVES

Total capital cost is based on a single curve having a tank diameter of (X), in meters. The curves are valid for tank diameters between 2.74 to 45.72 m (cross-sectional area ranging from 5.9 to 1,642 m<sup>2</sup>), operating three shifts per day. The curve includes all costs associated with acquisition and installation of concrete pad, clarifier structure, and control/monitor equipment for sludge level and sludge density control.

The total clarification capital cost derived from the curve is a combination of the following costs:

Construction labor cost.....	19%
Construction supply cost.....	5%
Purchased equipment cost.....	76%

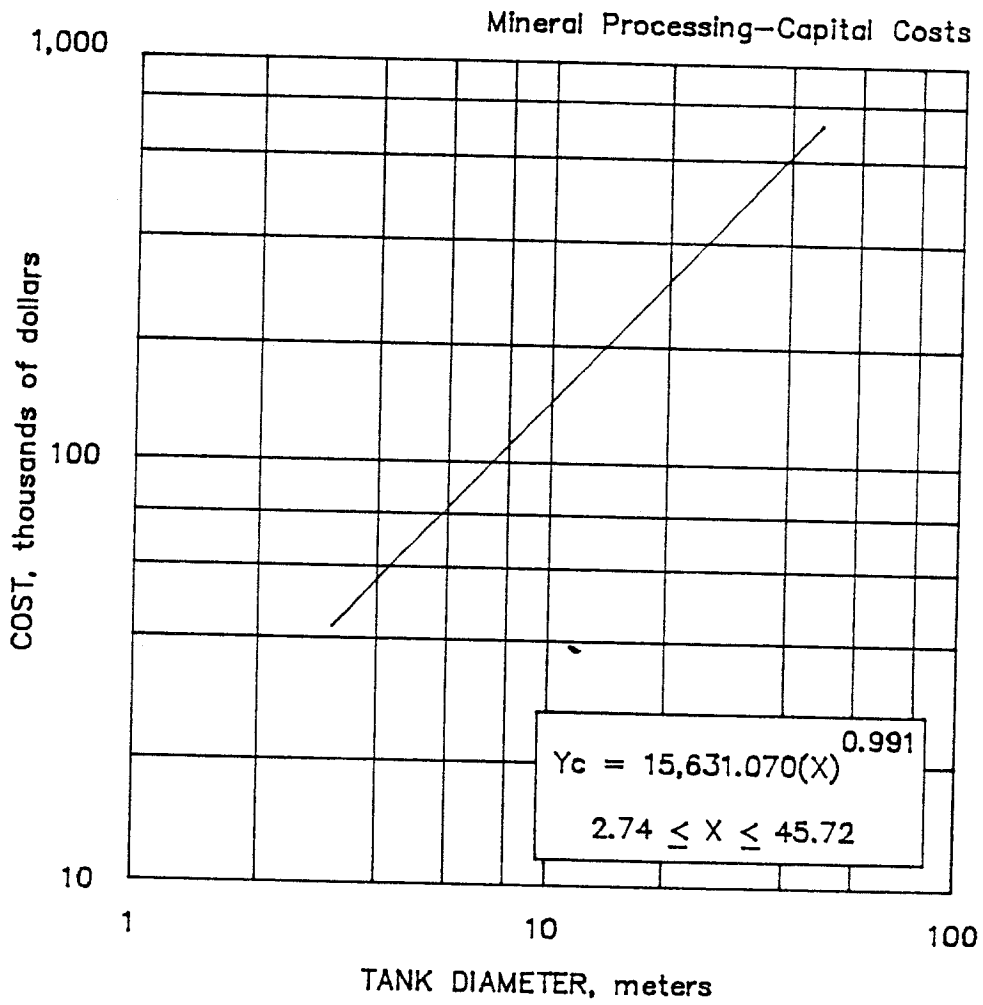
The total clarification capital cost is  $(Y_C) = 15,631.070(X)^{0.991}$  and is distributed as follows:

- (L) Construction Labor Cost  $(Y_L) = 2,969.910(X)^{0.991}$   
 (S) Construction Supply Cost  $(Y_S) = 781.550(X)^{0.991}$   
 (E) Purchased Equipment Cost  $(Y_E) = 11,879.610(X)^{0.991}$

NOTE--Sizing of clarifier is based on one principal parameter--rise rate, the vertical velocity of the stream through the clarifier. If the diameter or cross-sectional area of the clarifier is unknown, and the feed flow rate is known and the rise rate is assumed to be 0.015 m/min, then the diameter (D), or equivalent cross-sectional area, of the clarifier can be estimated with the equation:

$$\text{Clarifier diameter } (D) = 1.128[(Q)/(R)]^{0.500}$$

where R = rise rate, in meters per minute,  
 and Q = design flow rate, in cubic meters per minute.



6.1.10.3.1. Wastewater treatment  
CLARIFICATION

## 6.1. MINERAL PROCESSING--CAPITAL COSTS

## 6.1.10. INFRASTRUCTURE

6.1.10.3.2. WASTE WATER TREATMENT  
NEUTRALIZATION

The Environmental Protection Agency's publication EPA-600/2-82-00/d "Treatability Manual, Vol. IV, Cost Estimating," April 1983, was the source of cost development. One is referred to this manual if further detail in neutralization costs is needed. Additionally, other waste water treatment methods are costed in this EPA manual.

The capital cost curves cover neutralization of waste water effluent (out-of-pipe) when required. The basic design variable is waste water flow. Applicability of the curves are for effluent to be neutralized that ranges in volume from 0.001 to 876 L/s (22.8 to 20 million gal/d). It is assumed that flow equalization is provided by a tailings pond. The costs apply to the neutralization of either acidic or basic waste water streams originating from mine, mill, or combined mine and mill after it flows out-of-pipe from the central impoundment pond. In most mining operations further waste water treatment costs are not required. The system consists of chemical addition and two-stage neutralization tanks. It is assumed that pH and suspended-dissolved solid content of influent to the system will be unknown at this level of costing. Basis of design uses a standard dosage of 100 mg/L lime and 100 mg/L acid to achieve a pH of 7.0 over a pH range of 6.5 to 8.0.

## BASE CURVES

Total capital cost is based on a single curve having an average waste water flow rate (X), in liters per second. The curves are valid for 0.001 to 876 L/s, operating three shifts per day. The curves include all costs associated with the construction of the treatment facility including mixing tank, attenuation tank, chemical storage, agitators, piping, electrical, and instrumentation.

The capital cost derived from the curve is a combination of the following costs:

Construction labor cost.....	22%
Construction supply cost.....	13%
Purchased equipment cost.....	65%

For waste water effluent rates between 0.001 to 8.76 L/s, the capital cost is  $(Y_C \text{ 0.001-8.76 L/s}) = 123,144.490(X)^{0.094}$  and is distributed as follows:

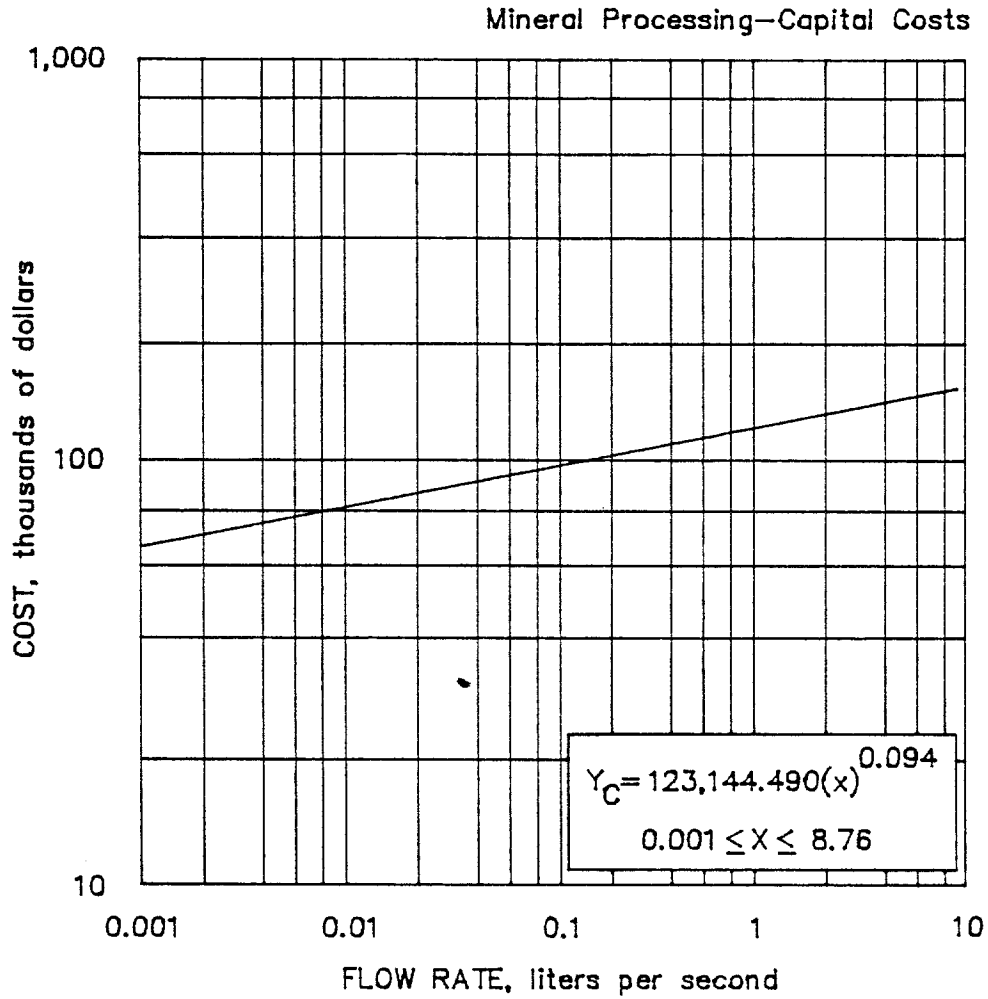
(L) <u>Construction Labor Cost</u>	$(Y_L \text{ 0.001-8.76 L/s}) = 80,043.930(X)^{0.094}$
(S) <u>Construction Supply Cost</u>	$(Y_S \text{ 0.001-8.76 L/s}) = 27,091.780(X)^{0.094}$
(E) <u>Purchased Equipment Cost</u>	$(Y_E \text{ 0.001-8.76 L/s}) = 16,008.780(X)^{0.094}$

For waste water effluent rates between 8.76 to 876 L/s, the capital cost is  $(Y_C \text{ 8.76-876 L/s}) = 26,346.39(X)^{0.562}$  and is distributed as follows:

(L) Construction Labor Cost  $(Y_L \text{ 8.76-876 L/s}) = 17,125.15(X)^{0.562}$

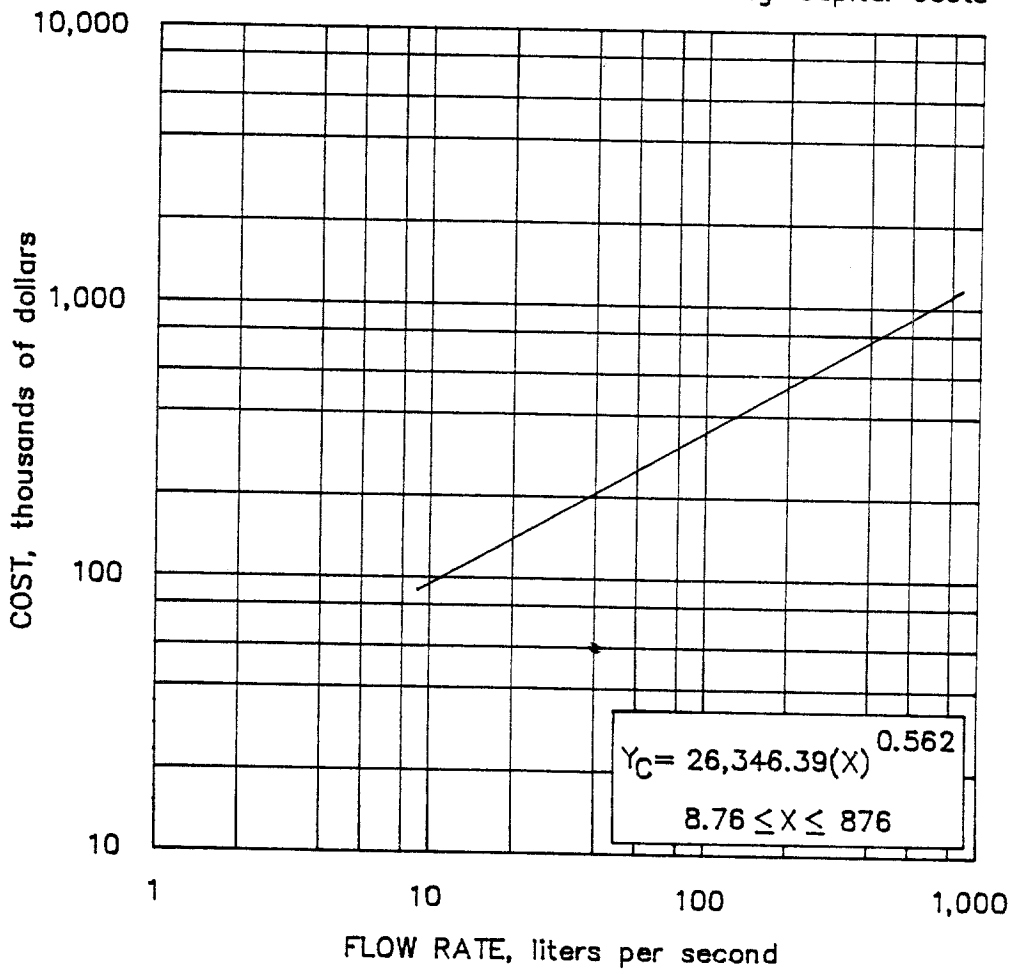
(S) Construction Supply Cost  $(Y_S \text{ 8.76-876 L/s}) = 5,796.21(X)^{0.562}$

(E) Purchased Equipment Cost  $(Y_E \text{ 8.76-876 L/s}) = 3,425.03(X)^{0.562}$



6.1.10.3.2.a Wastewater treatment  
NEUTRALIZATION

Mineral Processing—Capital Costs



6.1.10.3.2.b Wastewater treatment  
NEUTRALIZATION