

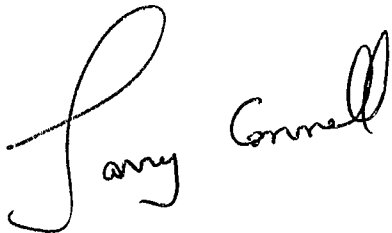
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## TRANSMITTAL

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**to:** Dave Anthony  
**fax #:** (403) 669-9424  
**re:** Construction of an SO<sub>2</sub> - Air Effluent Treatment Plant at the Giant Mill  
**date:** August 1, 1995  
**pages:** 12, including cover sheet.

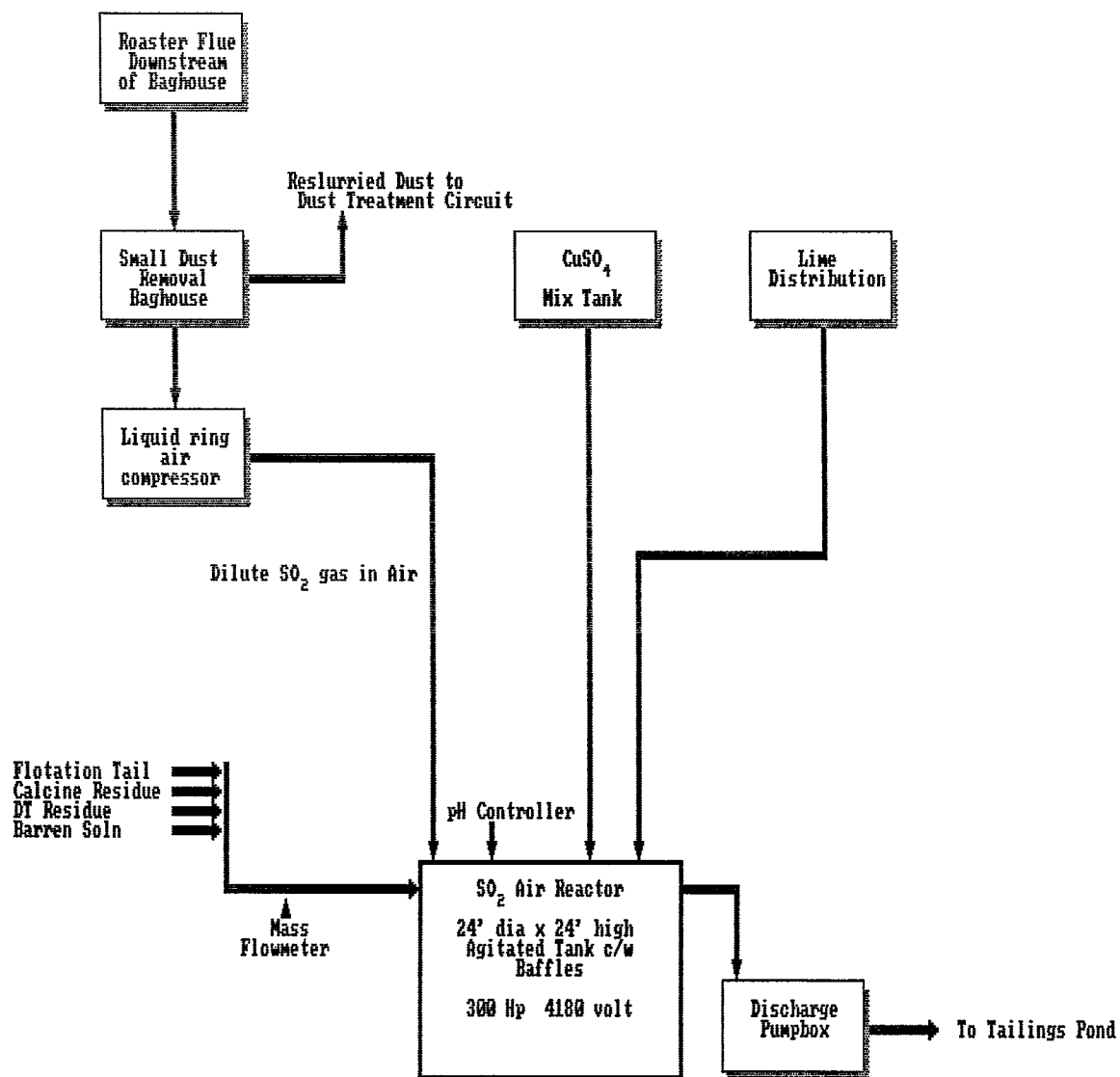
I finally located my cost estimate for the construction of an SO<sub>2</sub> - Air effluent treatment plant at the mill at Giant. The work was done in February of 1993. I will send a photocopy in the mail as I suspect the FAX will not keep all of these spreadsheet numbers readable.

A handwritten signature in cursive script that reads "Larry Connell".

From the desk of...

Larry Connell  
Manager of Environmental Services  
Royal Oak Mines Inc.  
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		TPD Solids	wt% Solids	TPD Solution	Volume of Solids Imp gal/day	Volume of Water Imp gal/day	Total Volume Imp gal/day	Volume of Water IGPM	Total Volume IGPM	Percent of Total Flow
A	Flotation Tails	1100	35	2040	78468	408035	486503	283	338	37.6%
B	Calcine Residue	150	50	150	10700	29961	40661	21	28	3.1%
C	Barren Bleed Solution	0	NA	400	0	79895	79895	55	55	6.2%
D	Dust Treatment Residue	25	35	46	1783	9274	11057	6	8	0.9%
E	Minewater	0	NA	2885	0	576242	576242	400	400	44.5%
F	Calcine Wash Thick O/F	0	NA	500	0	99869	99869	69	69	7.7%
G	Feed to Cyanide Destruct	1275	21	6021	90952	1202687	1293639	835	898	100.0%
H	TRP Thickener U/F	1275	50	1273	90952	254665	345617	177	240	26.7%
I	TRP Thickener O/F	0	NA	4748	0	948022	948022	658	658	73.3%
J	Recycle Water to Roaster	0	NA	1440	0	288000	288000	200	200	30.4%
K	Recycle Water to Mine	0	NA	864	0	172800	172800	120	120	18.2%
L	Treated Water to Baker Cr	0	NA	2444	0	487222	487222	338	338	51.4%

## Effluent Treatment Circuit Tank Sizing:

	TPD Solids	wt% Solids	TPD Solution	Volume of Solids imp gal/day	Volume of Water imp gal/day	Total Volume imp gal/day
Flotation Tails	1100	35		78468	408035	486503
Calcine Residue	150	50		10700	29961	40661
Dust Treatment Residue	25	35		1783	9274	11057
Barren Bleed Solution	0	-	406	0	79895	79895
Wash Thickener O/F	0	-	500	0	99869	99869
Minewater	0	-	2880	0	576000	576000

Total Volume to be treated 1293984

A SO<sub>2</sub>-Air Reaction Tanks  
2 Tanks - 25' diameter by 15' high

Allow for 1 foot of freeboard on each tank

Allow for 10% expansion in volume due to intense aeration

Volume Treated

Corrected

for Aeration

(ISPD)

	Diameter (feet)	Height (feet)	Tank Volume (cu ft)	Tank Volume (imp gal)	Volume Treated Corrected for Aeration (ISPD)
SO <sub>2</sub> /Air Reactor #1	25	14	6378	39728	1423383
SO <sub>2</sub> /Air Reactor #2	25	14	6378	39728	1423383

B Arsenic Removal Tank  
1 Tank - 25' diameter by 15' high

Allow for 1 foot of freeboard on each tank

Ferric Addition	Reactor #3	25	14	6378	39728	1293984
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C	Thickener	Theoretical			Capacity of TRP Thickener (Tons)
		Settling Rate (FT/HR)	Required Thickener Area (FT <sup>2</sup> /TON)	Required Thickener Area (FT <sup>2</sup> )	
	Flotation Tails Only	0.1627	7.03	7733	715
	Mill Tails & Minewater				

Mill SO2/Air Effluent Treatment Plant - Page :

		Unit Loaded Labour Cost:	\$27.00	LABOUR M/H	LABOUR COST	MATERIAL	OTHER SERVICES	TOTAL
Reaction Tanks								
Base Preparation								
1. Prepare crushed, compacted gravel (-1" + 3/4") pad for reaction tanks								
Size of Pad: 115' x 55' => 6,325 sq ft								
Estimated gravel required: depth 3' x 6,325 sq ft => 703 cubic yards								
2 men(loader op & Truck driver/labourer) x 12 hours per day x 14 days				336	\$9,072.00			
703 cubic yards x 3 tons/yd3 x \$10/ton						\$21,090.00		
2 week rental of portable compactor							\$2,500.00	\$32,662.00
2. Install HDPE spill liner and berm								
HDPE Liner - 80 mil: 115' x 55' x 5% allowance for seam overlap => 6641 sq. ft.								
4 men x 12 hours/day x 7 days				336	\$9,072.00			
6641 sq ft of liner x \$4.00/ft2						\$26,564.00		
1 week rental of seam fusing machine							\$1,000.00	\$36,636.00
Gravel for Berm (3 ft high @ 1:1 slopes): 120 cubic yards								
2 men(loader op & labourer) x 12 hours/day x 7 days				168	\$4,536.00			
120 cubic yards x 3 tons/yd3 x \$10/ton						\$3,600.00		
1 week rental of portable compactor							\$1,000.00	\$9,136.00
3. Form and Pour concrete sump: 4' x 4' x 4' deep								
2 men x 12 hours/day x 4 days				96	\$2,592.00			
4 cubic yards x \$200/yd3 + \$200 of lumber						\$1,000.00		\$3,592.00
Tank Installation								
4. Dissassemble and reassemble three 25' diameter x 15' high bolted steel tanks								
Each Tank has 78.5' x 15' => 1,178 sq ft of wall								
Assume wall panels are 4' x 8' => 40 panels per tank								
Assume new gaskets and bolts are required								
4 men x 12 hours/day x 28 days				1344	\$36,288.00			
New gaskets & Bolts + slings & welding gasses & rods						\$10,000.00		
Rental of boom truck for 28 days @ \$60/hr + scaffolding & Air Compressor							\$25,000.00	\$71,288.00
5. Fabricate and install agitator bridge for each tank (3 bridge structures)								
Assume the agitator bridges will have to be supported from the ground								
Two of the bridges will have to be strong enough to accomodate higher torque mixing								
4 men x 12 hours/day x 10 days/bridge x 3 units				1440	\$38,880.00			
10 tons of steel per bridge & support x 3 units x \$460/ton +								
\$2,500 of hardware, welding materials, etc.						\$17,500.00		
Crane rental for 4 days per bridge @ \$60/hr x 3 units							\$8,640.00	\$65,020.00
Fabricate and install walkways c/w handrails across all three reaction tanks (95 feet).								
2 men x 12 hours/day x 2 days/tank x 3 units				144	\$3,888.00			
4 tons of steel per tank x 3 units x \$500/ton						\$6,000.00		
Crane rental for 2 days per tank @ \$60/hour x 3 units							\$4,320.00	\$14,208.00
Fabricate and install two access stairways to tank #1 & 3								
1 man x 12 hours/day x 7 days				84	\$2,268.00			
3 tons of steel x \$500/ton						\$1,500.00		\$3,768.00
Purchase of two high shear agitator mechanisms for 25' dia by 15' high tank						\$200,000.00		\$200,000.00
c/w 150 to 200 Hp electric motors and motor control centres								
7. Purchase of one low shear agitator mechanism for 25' dia by 15' high tank						\$75,000.00		\$75,000.00
c/w 35 to 50 Hp electric motor and motor control centre								
8. Installation of all three agitator mechanisms, shafts and blades								
4 men x 12 hours/day x 7 days				336	\$9,072.00			
Miscellaneous hardware						\$1,000.00		
Crane rental for 7 days @ \$60/hr							\$5,040.00	\$15,112.00
9. Fabrication and installation of 8" diameter feed and discharge nozzle on tank #1, 2 and 3								
1 man x 3 days x 12 hours/day				36	\$972.00			
Miscellaneous pipe, steel flanges & hardware						\$1,000.00		\$1,972.00
10. Fabrication and installation of one upcomer pipe (12" dia) on each tank								
2 men x 12 hours/day x 3 days				72	\$1,944.00			
2 x 20' lengths of 12" dia schedule 40 steel pipe + Welding supplies						\$4,000.00		
Crane rental for 3 days @ 60/hr							\$2,160.00	\$8,104.00

11. Fabrication and installation of three wall mounted baffles in each tank 2 men x 12 hours/day x 3 days/tank x 3 tanks 3 tons of steel/tank x 3 tanks x \$500/ton Crane rental for 3 days per tank x 3 tanks @ \$60/hr	216	\$5,832.00	\$4,500.00	\$6,480.00	\$16,812.00
Installation of Piping and Pumps					
12. Feed Line to Reaction Tanks - 8" HDPE Assume 1000 linear feet of 8" diameter HDPE pipe (New) 3 men x 12 hours/day x 7 days 1000 feet of 8" HDPE pipe @ \$12/ft	252	\$6,804.00	\$12,000.00	\$0.00	\$18,804.00
Assume 2 x 8" diameter knife gate valves (TRP) 2 men x 12 hours/day x 2 days 2 valves with air actuators @ \$2,500 each	48	\$1,296.00	\$5,000.00	\$0.00	\$6,296.00
Assume 4 x 90 degree elbows and 4 flange sets (TRP)			\$2,500.00	\$0.00	\$2,500.00
13. Feed line between tank #1 and 2 - 8" HDPE Assume 10 feet of pipe with no elbows flanged at each end 1 man x 12 hours/day x 1 day Miscellaneous pipe & Flanges	12	\$324.00	\$600.00	\$0.00	\$924.00
14. Feed line between tank #2 and 3 - 8" HDPE Assume 10 feet of pipe with no elbows flanged at each end 1 man x 12 hours/day x 1 day Miscellaneous pipe & Flanges	12	\$324.00	\$600.00	\$0.00	\$924.00
15. Overhaul and install two 10 x 8 SRL pumps at discharge of #3 tank Assume pumps, motors and motor control centres are available from TRP but require rebuild Assume one pump running, one on standby 2 men x 12 hours/day x 4 days (2 days per pump) New suction and discharge side liners, impeller and bearings (\$3,000/pump)	96	\$2,592.00	\$6,000.00	\$0.00	\$8,592.00
Fabrication and installation of pumpbox 6' x 6' x 6' high with two 10" discharge nozzles 2 men x 12 hours/day x 7 days 3 tons of steel x \$500/ton	168	\$4,536.00	\$1,500.00	\$0.00	\$6,036.00
Tank to Pumpbox - assume 10 feet of 8" diameter pipe flanged at both ends - HDPE 1 man x 12 hours/day x 1 day Miscellaneous pipe, flanges and hardware	12	\$324.00	\$1,000.00	\$0.00	\$1,324.00
Assume 1 x 8" 90 degree elbows (from TRP) Pumpbox to discharge pumps - assume 2 x 8" knife gate valves (TRP) 1 man x 12 hours/day x 1 day	12	\$324.00	\$0.00	\$0.00	\$324.00
Assume one 8" x 8" x 8" flanged end pipe wye to be fabricated or purchased and installed 1 man x 12 hours/day x 2 days Miscellaneous 8" pipe, flanges and hardware	24	\$648.00	\$1,000.00	\$0.00	\$1,648.00
16. Install heated building over 10 x 8 Discharge pumps Assume steel insulated building 20' x 10' x 10' high with double wide doors 4 men x 12 hours/day x 8 days Purchase of steel frame building + cladding (\$50/sq ft)	384	\$10,368.00	\$10,000.00	\$0.00	\$20,368.00
Concrete footing for building 2 men x 12 hours/day x 2 days 2.5 cubic yards of concrete @ \$200/yd3 + \$200 of lumber	48	\$1,296.00	\$700.00	\$0.00	\$1,996.00
Purchase and installation of two electric space heaters for building 1 man x 12 hours/day x 1 day purchase of 2 space heaters + power supply cable	12	\$324.00	\$1,000.00	\$0.00	\$1,324.00
17. Discharge Line between the mill and the TRP Thickener - 8" HDPE Assume 3600 feet of new 8" diameter HDPE pipe to be purchased and installed Assume HDPE welded construction 3 men x 12 hours/day x 4 days 3,600 feet of 8" diameter HDPE pipe @ \$12/foot	144	\$3,888.00	\$43,200.00	\$0.00	\$47,088.00
Assume two 8" x 8" x 6" tees and two 6" drain valves required 1 Tee + 2 x 6" valves + couplings and hardware	0		\$3,000.00	\$0.00	\$3,000.00
One drain at the pump end and one at the central tailings pond					

18. Roadbed for Discharge line between the mill and the TRP Thickener

Assume 1800 feet of 10 foot wide roadbed to be constructed along edge of central pond

Assume 3500 cubic yards of run of mine waste rock

400 truck loads x 0.5 hours per trip => 200 manhours

200 \$5,400.00 \$0.00 \$0.00 \$5,400.00

Instrumentation

19. Mass Flowmeter on feed line to tank #1 (Available from TRP)

Relocation of mass flowmeter (Flowmeter and Density gauge) from the TRP

to the 8" diameter feed line to #1 Tank

2 men x 12 hours/day x 2 days

48 \$1,296.00

Miscellaneous hardware

\$250.00

\$0.00 \$1,546.00

Output signal and power cable installation associated with the mass flowmeter

1 man x 12 hours/day x 2 days

24 \$648.00

Miscellaneous cable & hardware

\$1,000.00

\$0.00 \$1,648.00

20. Installation of 3 pH controllers - Tank #1, Tank #3 and in pumpbox after tank #3

1 man x 12 hours/day x 3 days

36 \$972.00

Miscellaneous mounting hardware

\$500.00

\$0.00 \$1,472.00

Output signal and power cable installation associated with the pH controllers

1 man x 12 hours/day x 3 days

36 \$972.00

Miscellaneous mounting hardware & cable

\$1,000.00

\$0.00 \$1,972.00

TRP Thickener

Winterization of TRP Thickener

1. Installation of building enclosure around bottom of thickener

Concrete footing

2 men x 12 hours/day x 7 days

168 \$4,536.00

10 cubic yards of concrete @ \$200/yd3 + \$500 of lumber

\$2,500.00

\$0.00 \$7,036.00

Steel enclosure c/w siding and insulation around bottom of thickener

- 270 feet of perimeter by an average of 15 feet in height => 4,050 sq ft

4 men x 12 hours/day x 14 days

672 \$18,144.00

4,050 square feet of wall surface x \$15/sq ft

\$60,750.00

\$0.00 \$78,894.00

2. Insulation and cladding around thickener tank

- perimeter of 270 feet by 10 feet high => 2700 square feet

2 men x 12 hours/day x 7 days

168 \$4,536.00

2,700 square feet of wall surface x \$15/sq ft

\$40,500.00

\$0.00 \$45,036.00

3. Insulate and clad around the thickener feed tank (Dewater Tank)

- perimeter of approximately 35' by 15' high => 525 sq ft

2 men x 12 hours/day x 2 days

48 \$1,296.00

525 square feet of wall surface x \$15/sq ft

\$7,875.00

\$0.00 \$9,171.00

4. Enclosure over top of thickener

5,024 square feet @ \$40 per square foot of building enclosure

\$200,960.00

\$200,960.00

5. Building enclosure over thickener overflow tank and pumps

Purchase and erection of an insulated steel clad frame building

Approximate dimensions: 20' x 20' x 20' high

Alternative is to relocate thickener overflow tank and pumps into a corner of the existing screen building and erect an internal wall

4 men x 12 hours/day x 14 days

672 \$18,144.00

Miscellaneous steel, pipe and hardware

\$4,000.00

\$5,040.00 \$27,184.00

Crane rental for 7 days @ \$60/hr

6. Purchase and install electrical space heating for under the thickener

and for the thickener overflow tank enclosure.

1 man x 12 hours/day x 5 days

60 \$1,620.00

Purchase of 6 heaters + cable @ \$500 per heater

\$3,000.00

\$0.00 \$4,620.00

## Installation of Piping and Pumps

## 7. Thickener Underflow Pumps

Overhaul and install two 10 x 8 SRL pumps as thickener underflow pumps	192	\$5,184.00			
2 men x 12 hours/day x 8 days (4 days per pump)					
Replacement suction and discharge liners, impellor and bearings (\$3,000 per pump)			\$6,000.00	\$0.00	\$11,184.00
Assume pumps, motors and motor control centres are available from TRP but require rebuild					
Assume one pump running, one on standby					
Install one pump on existing base and connect up existing feed pipes					
Install second pump on existing base.					
Fabricate and install second discharge nozzle (10" diameter) in thickener U/F cone					
1 man x 12 hours/day x 2 days	24	\$648.00			
Miscellaneous 10" diameter pipe and flanges			\$2,000.00	\$0.00	\$2,648.00
Install feed piping for second 8 x 10 pump					
2 men x 12 hours/day x 3 days	72	\$1,944.00			
Miscellaneous pipe, fittings and hardware			\$3,000.00	\$0.00	\$4,944.00
- require one 45 degree elbow and one 10" diameter knife gate valve			\$2,500.00		\$2,500.00
Install discharge piping from both pumps - 8" HDPE					
2 men x 12 hours/day x 3 days	72	\$1,944.00			
Miscellaneous pipe, fittings and hardware			\$2,000.00	\$0.00	\$3,944.00
- require fabrication or purchase of one 8" x 8" x 8" flanged pipe wye					
1 man x 12 hours/day x 3 days	36	\$972.00			
Miscellaneous pipe, flanges and hardware			\$1,500.00	\$0.00	\$2,472.00

## 8. Thickener Overflow Pumps

Overhaul and install two 61W pumps on thickener overflow tank					
Assume pumps, motors and motor control centres are available from TRP but require rebuild					
Assume one pump running, one on standby					
Install one pump on existing base and connect up existing feed pipes					
2 men x 12 hours/day x 8 days (4 days per pump)	192	\$5,184.00			
Replacement suction and discharge liners, impellor and bearings (\$3,000 per pump)			\$6,000.00	\$0.00	\$11,184.00
Form and pour second pump base					
1 man x 12 hours/day x 2 days	24	\$648.00			
2 cubic yards of concrete + Lumber			\$600.00	\$0.00	\$1,248.00
Install pump on second pump base					
Install 6" diameter feed lines to O/F pumps - length 10 foot each pump					
- require two 6" knife gate valves					
1 man x 12 hours/day x 2 days	24	\$648.00			
2 valves c/w actuators @ \$1,500 each			\$3,000.00	\$0.00	\$3,648.00
Heat trace and insulate 30 foot of overflow piping between thickener O/F					
launder and overflow pumpbox.					
1 man x 12 hours day x 1 days	12	\$324.00			
30' of heat tracing & insulation @ \$15/ft			\$450.00	\$0.00	\$774.00

## 9. Thickener Cone Drain Line - 10" Diameter

Recondition existing thickener underflow drain line. The piping and isolation valve are all in place. The couplings will have to be cleaned and reassembled.					
1 man x 12 hours/day x 1 day	12	\$324.00			
Miscellaneous hardware & couplings			\$200.00	\$0.00	\$524.00

## 10. Thickener U/F line to Northwest Tailings Pond - 8" HDPE

Purchase and install 5400' of 8" HDPE pipe all welded construction between the TRP Thickener U/F pump and the Northwest tailings pond. An additional 3600' of existing 8" HDPE line will have to be tied in to permit spigotting along Dam #21 A, B, C & D and dam # 22 A & B.					
3 men x 12 hours/day x 8 days	288	\$7,776.00			
5,400 feet of 8" HDPE pipe @ \$12/ft			\$64,800.00	\$0.00	\$72,576.00

## 11. Thickener U/F Line to South Pond - 8" HDPE

Purchase and install 4800' of 8" HDPE pipe all welded construction between the TRP Thickener underflow pumps and Dam # 11 at the South Tailings Pond.					
3 men x 12 hours/day x 6 days	216	\$5,832.00			
4,800 feet of 8" HDPE pipe @ \$12/ft			\$57,600.00	\$0.00	\$63,432.00



12. Thickener Overflow Line to Mill Water Tank and U/G Mine - 6" Insulated heat traced HDPE  
Purchase and install 4500' of 6" diameter heat traced and insulated HDPE pipe between  
the TRP thickener overflow pumps and the mill.

3 men x 12 hours/day x 6 days

4,500 feet of 6" HDPE heat traced and insulated pipe @ \$15/ft

216 \$5,832.00 \$67,500.00 \$0.00 \$73,332.00

Reagent Systems

S02 System

1. Low Pressure S02 Air Compressor/Blower

Purchase and install Stainless steel Liquid Ring Air compressor

2 men x 12 hours/day x 4 days

New Stainless steel liquid ring air compressor

96 \$2,592.00 \$50,000.00 \$0.00 \$52,592.00

- require 50 Hp electric motor and motor control centre

2 men x 12 hours/day x 1 day to install and wire motor and MCC

New 50 Hp motor and MCC

24 \$648.00 \$14,000.00 \$0.00 \$14,648.00

- require cartridge dust filter ahead of compressor

2 men x 12 hours/day x 1 day

Purchase of filter element

24 \$648.00 \$3,500.00 \$0.00 \$4,148.00

Purchase and install insulated steel frame building to house S02 Compressor

- approximate size 10' x 20' x 10' high with double wide doors

4 men x 12 hours/day x 8 days

Purchase of steel frame building + cladding (\$50/sq ft)

384 \$10,368.00 \$10,000.00 \$0.00 \$20,368.00

- require concrete footing and gravel floor

2 men x 12 hours/day x 2 days

2.5 cubic yards of concrete @ \$200/yd3 + \$200 of lumber

48 \$1,296.00 \$700.00 \$0.00 \$1,996.00

- require electric space heating

1 man x 12 hours/day x 1 day

purchase of 2 space heaters + power supply cable

12 \$324.00 \$1,000.00 \$0.00 \$1,324.00

2. Piping (Stainless Steel or Fibreglass Reinforced Plastic) - 8" Diameter

Compressor Intake - Between stack flue liquid ring air compressor

- require one 8" diameter stainless knife gate valve

1 man x 12 hours/day x 1 day

Purchase of valve & Hardware

12 \$324.00 \$2,500.00 \$0.00 \$2,824.00

- approximately 100 feet of 8" SS or FRP pipe

2 men x 12 hours/day x 2 days

Stainless steel 8" pipe and mounting hardware (100 ft @ \$20/ft)

48 \$1,296.00 \$2,500.00 \$0.00 \$3,796.00

Compressor Discharge - Between liquid ring air compressor and reaction tank #1 & 2

- require approximately 200 feet of 8" SS pipe

2 men x 12 hours/day x 4 days

Stainless steel 8" pipe and mounting hardware (200 ft @ \$20/ft)

96 \$2,592.00 \$5,000.00 \$0.00 \$7,592.00

- require 60 feet of 4" SS pipe for in tank spargers

2 men x 12 hours/day x 1.5 days

Stainless steel 4" pipe and mounting hardware (60 ft @ \$10/ft)

36 \$972.00 \$600.00 \$0.00 \$1,572.00

- require two 4" SS knife gate valves, one 8" x 4" x 4" SS mve.

\$2,500.00 \$2,500.00

Lime System

1. Lime Storage Silo, Slaker and Mix Tank

Clean lime out of the TRP plant lime silo

96 \$2,592.00 \$1,600.00 \$0.00 \$3,592.00

Miscellaneous hardware, lumber and welding supplies

Disassemble and reassemble TRP Lime Storage silo c/w slaker and mix tank  
at the mill

6 men x 12 hours/day x 21 days

New gaskets, bolts, hardware and welding supplies

1512 \$40,824.00 \$7,500.00 \$15,120.00 \$63,444.00

Rental of boom truck for 21 days @ \$60/hr + scaffolding & air compressor

Overhaul and install Lime Distribution pump

1 man x 12 hours/day x 2 days

Impellor, bearings and mounting hardware

24 \$648.00 \$1,500.00 \$0.00 \$2,148.00

Install line distribution loop with takeoffs to #1 and 2 tanks and to pumpbox at the discharge of # 3 reaction tank

- require approximately 600' of 2" diameter pipe	168	\$4,536.00			
2 men x 12 hours/day x 7 days					
600' of 2" pipe, couplings and mounting hardware			\$3,000.00	\$0.00	\$7,536.00
- require 3 x 2" red jacket valves c/w solenoid actuators					
1 man x 12 hours/day x 1 day	12	\$324.00			
Red Jacket valves, solenoids and mounting hardware			\$500.00	\$0.00	\$824.00
- require approximately 100 feet of 1" diameter pipe to supply compressed air to the line control valves					
1 man x 12 hours/day x 2 days	24	\$648.00			
100' of 1" pipe, couplings and mounting hardware			\$500.00	\$0.00	\$1,148.00
Install electric space heater in bottom of line silo					
1 man x 12 hours/day x 1 day	12	\$324.00			
1 space heater and power supply cable			\$500.00	\$0.00	\$824.00

#### Ferric Sulphate System

##### 1. Storage Tanks

Purchase and install two liquid ferric sulphate storage tanks on gravel pads.

The storage tanks would be identical in sizing to those at the present ETP

4 men x 12 hours/day x 4 days	192	\$5,184.00			
Purchase of two storage tanks			\$50,000.00		
Crane Rental for two days @ \$60/hr				\$1,440.00	\$56,624.00
- require feed line to each tank					
1 man x 12 hours/day x 2 days	24	\$648.00			
Stainless steel pipe, fittings, valves and mounting hardware			\$1,000.00	\$0.00	\$1,648.00
- require catchbasin around storage tanks (place inside bermed area for the reaction tanks					

##### 2. Metering Pumps and Loop

Purchase and install two LMI metering pumps

1 man x 12 hours/day x 1 day	12	\$324.00			
Purchase of 2 pumps @ \$2,000 each			\$4,000.00	\$0.00	\$4,324.00
Install ferric sulphate distribution loop					
- require 500' of 1" diameter SS pipe					
2 men x 12 hours/day x 4 days	96	\$2,592.00			
Stainless steel pipe, fittings, valves and mounting hardware			\$4,000.00	\$0.00	\$6,592.00

#### Copper Sulphate System

##### 1. Storage and Mix Tank

Move two 2000 gallon plastic tanks

2 men x 12 hours/day x 7 days	168	\$4,536.00			
Lumber for access deck and stairway			\$3,000.00	\$0.00	\$7,536.00
Overhaul and install agitator in each tank					
2 men x 12 hours/day x 2 days	48	\$1,296.00			
Miscellaneous repair parts, ie. bearings, impeller, etc.			\$1,000.00	\$0.00	\$2,296.00
Purchase and install transfer pump					
2 men x 12 hours/day x 1 day	24	\$648.00			
Purchase of pump & motor			\$2,500.00	\$0.00	\$3,148.00
Purchase and install 1 tonne overhead hoist to move CuSO4 bags					
2 men x 12 hours/day x 2 days	48	\$1,296.00			
Purchase of hoist @ \$3,000 + overhead monorail and support steel			\$4,000.00	\$0.00	\$5,296.00

2. Metering Pumps and Loop							
Purchase and install two LMI metering pumps							
	1 man x 12 hours/day x 1 day	12	\$324.00				
	Purchase of 2 pumps @ \$2,000 each			\$4,000.00	\$0.00	\$4,324.00	
Install copper sulphate distribution loop							
- require 500' of 1" diameter SS pipe							
	2 men x 12 hours/day x 4 days	96	\$2,592.00				
	Stainless steel pipe, fittings, valves and mounting hardware			\$4,000.00	\$0.00	\$6,592.00	
Electrical Power							
High Voltage							
1. Relocate one Transformer from TRP to Mill Substation							
-require line work to separate the two transformers at the TRP substation							
	2 men x 12 hours/day x 4 days	96	\$2,592.00				
	Cable - high voltage			\$2,000.00	\$0.00	\$4,592.00	
- require concrete pad for transformer							
	2 men x 12 hours/day x 1 day	24	\$648.00				
	7.4 cubic yards of concrete @ \$200/yd3			\$1,481.48	\$0.00	\$2,129.48	
- require new pole and cable to feed high voltage side of transformer							
	2 men x 12 hours/day x 1.5 days	36	\$972.00				
	Power pole & high voltage cable			\$2,500.00			
	Rental of auger & boom truck for 1 day				\$720.00	\$4,192.00	
- require new pole and cable to transfer 575 V power to mill switchroom							
	2 men x 12 hours/day x 1.5 days	36	\$972.00				
	Power pole & high voltage cable			\$2,500.00			
	Rental of auger & boom truck for 1 day				\$720.00	\$4,192.00	
2. Relocate power Distribution rack from TRP to mill to distribute new 575V power							
	2 men x 12 hours/day x 3 days	72	\$1,944.00				
	Electrical cable & hardware			\$1,000.00			
	Rental of Boom truck for 1 day				\$720.00	\$3,664.00	
3. Installation of new motor control centres (moved from TRP)							
- require approximately 750 Hp of 575 V power							
	2 men x 12 hours/day x 5 days	120	\$3,240.00				
	Electrical cable & hardware			\$5,000.00	\$0.00	\$8,240.00	
						SUB-TOTAL	\$1,632,072.48
Allowance for Freight							\$50,000.00
Allowance for Engineering							\$50,000.00
						TOTAL	\$1,732,072.48
Contingency Allowance							\$519,621.74
						TOTAL	\$2,251,694.23

Operating Cost Estimate	OPTION A		OPTION B		
	New SO2/Air Treatment Plant		Existing	Actual	Actual
	SO2/Air Treatment at Mill	Existing ETP at Tailings pond	ETP at Tailings pond	1992	1991
Volume Treated					
Solution (M3/yr)	1,995,563	223,107	2,204,762	2,204,762	
Slurry (M3/yr)	2,146,475	573,466	0		
Contaminants in Feed					
As (mg/l)	17.0	17.0	17.0		
CNT (mg/l)	23.0	23.0	23.0		
Labour					
Labour Rate/hr	\$15	\$15	\$15		
Payroll Burden	35%	35%	35%		
Loaded Labour Rate/hr	\$20	\$20	\$20		
# of People Required	2	1	1		
Work Schedule	24 h/d 356d/yr	8 h/d 5 d/w 1 month/yr	8 h/d 5 d/w 4 month/yr		
# of manhours/yr	4380	172	688		
Cost/yr	\$88,695	\$3,483	\$13,932		
Hydrogen Peroxide					
H2O2/CN Ratio		4	4		
Lbs of H2O2 Required		45211	446780	421,861	790,569
Cost/Lb FOB Yellowknife		\$0.3400	\$0.3400	\$0.3366	
Cost of H2O2/yr	\$0	\$15,372	\$151,905	\$141,977	\$332,092
Ferric Sulphate					
Fe/As ratio of 4	4	4	4	4	
Tons of Fe required	149	17	165	165	
Kgs of FeSO4 Required	821,961	91,897	908,129	890,375	839,892
Assume 40% Active Fe					
Cost/Kg FOB Yellowknife	\$0.3900	\$0.3900	\$0.3900	\$0.3900	
Cost of FeSO4/year	\$320,565	\$35,840	\$354,170	\$347,246	\$325,147
Copper Sulphate					
Consumption (Kg/M3)	0.0113	0.0113	0.0113	0.0113	
Kgs of CuSO4 Required	22630	2530	25002	25,000	50,000
Cost/Kg FOB Yellowknife	\$1.32	\$1.32	\$1.32	\$1.18	
Cost of CuSO4/yr	\$29,930	\$3,346	\$33,067	\$29,490	\$50,760
Lime					
Consumption(Kg/ton ore)	0.0832	0.0832	0.0832	0.0832	
Kgs of Lime Required	165,980	18,557	183,380	183,380	240,710
Cost/Kg FOB Yellowknife	\$0.2388	\$0.2388	\$0.2388	\$0.2388	
Cost of Lime/yr	\$39,644	\$4,432	\$43,799	\$18,786	\$23,697
Other Operating Supplies					
Gas Filter Elements	\$5,200	\$0	\$0		
Annual License Fee - Esti	\$150,000	\$0	\$0		
Sub Total	\$628,833	\$62,473	\$596,874		
Total Cost		OPTION A \$691,306	OPTION B \$596,874		
Annual Cost Saving			(\$94,432)		