

**WASTE HAULAGE AT MIRADOR**

	years == >	-1	1	2	3	4	5	6	7	8	9	10	11	12	13	total
	days/year == >	365	365	365	365	365	365	365	365	365	365	365	365	365	365	
<b>PHASE I</b>	upper working platform (masl) == >	1,580	1,268	1,244	1,220	1,208	1,184	1,160	1,124							
	main road level (masl) == >	1,340	1,340	1,340	1,340	1,340	1,340	1,340	1,340							
		120	-72	-96	-120	-132	-156	-180	-216							
	in pit road distance (m) 8%	2,000	-900	-1,200	-1,500	-1,650	-1,950	-2,250	-2,700							
	pit to waste dump road (m) 7% 1,340 1,292 down	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200							
	total haulage bench to wastedump (m)	3,200	2,100	2,400	2,700	2,850	3,150	3,450	3,900							
	Waste - Saprolite (Rippable)	9,860,000	9,457,000	1,203,000	289,000	231,000	89,000	0	0							21,129,000
	Waste - Sulphide (Drilled and blasted)	3,908,000	4,171,000	1,102,000	768,000	898,000	713,000	617,000	123,000							12,300,000
	Waste - Inferred (Drilled and blasted)	407,000	716,000	493,000	265,000	222,000	202,000	202,000	102,000							2,407,000
	Waste - Total	14,175,000	14,344,000	2,798,000	1,322,000	1,351,000	1,004,000	719,000	123,000							35,836,000
	TPD	38,836	39,299	7,666	3,622	3,701	2,751	1,970	337							
<b>PHASE II</b>	upper working platform (masl) == >			1,580	1,304	1,268	1,244	1,220	1,196	1,148	1,112	1,088				
	main road level (masl) == >			1,340	1,340	1,340	1,340	1,340	1,340	1,340	1,340	1,340				
				240	-36	-72	-96	-120	-144	-192	-228	-252				
	in pit road distance (m) 8%			3,000	-450	-900	-1,200	-1,500	-1,800	-2,400	-2,850	-3,150				
	pit to waste dump road (m) 7% 1,340 1,292 down			1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200				
	total haulage bench to wastedump (m)			4,200	1,650	2,100	2,400	2,700	3,000	3,600	4,050	4,350				
	Waste - Saprolite (Rippable)			1,763,000	1,813,000	1,072,000	924,000	422,000	111,000	38,000	0	0				6,143,000
	Waste - Sulphide (Drilled and blasted)			1,185,000	1,356,000	956,000	679,000	771,000	1,267,000	2,349,000	662,000	324,000				9,549,000
	Waste - Inferred (Drilled and blasted)			350,000	188,000	76,000	198,000	463,000	290,000	661,000	104,000					2,330,000
	Waste - Total			3,298,000	3,357,000	2,104,000	1,801,000	1,656,000	1,668,000	3,048,000	766,000	324,000				18,022,000
	TPD			9,036	9,197	5,764	4,934	4,537	4,570	8,351	2,099	888				
<b>PHASE III</b>	upper working platform (masl) == >			1,508	1,400	1,364	1,316	1,292	1,268	1,244	1,220	1,172	1,124	1,064	1,040	
	main road level (masl) == >			1,340	1,340	1,340	1,340	1,340	1,340	1,340	1,340	1,340	1,340	1,340	1,340	
				168	60	24	-24	-48	-72	-96	-120	-168	-216	-276	-300	
	in pit road distance (m) 8%			2,100	750	300	-300	-600	-900	-1,200	-1,500	-2,100	-2,700	-3,450	-3,750	
	pit to waste dump road (m) 7% 1,340 1,292 down			1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	
	total haulage bench to wastedump (m)			3,300	1,950	1,500	1,500	1,800	2,100	2,400	2,700	3,300	3,900	4,650	4,950	
	Waste - Saprolite (Rippable)			1,357,000	1,146,000	1,073,000	1,650,000	1,284,000	332,000	515,000	999,000	175,000				8,531,000
	Waste - Sulphide (Drilled and blasted)			28,000	1,227,000	1,356,000	1,412,000	2,043,000	3,663,000	2,208,000	3,435,000	3,734,000	2,233,000	2,178,000	209,000	23,726,000
	Waste - Inferred (Drilled and blasted)				80,000	90,000	36,000	205,000	122,000	140,000	677,000	1,665,000	1,578,000	450,000	14,000	5,057,000
	Waste - Total			1,385,000	2,453,000	2,519,000	3,098,000	3,532,000	4,117,000	2,863,000	5,111,000	5,574,000	3,811,000	2,628,000	223,000	37,314,000
	TPD			3,795	6,721	6,901	8,488	9,677	11,279	7,844	14,003	15,271	10,441	7,200	611	
	total drilled & blasted waste TPD (D&B waste)	4,315,000	4,887,000	3,158,000	3,884,000	3,598,000	3,240,000	4,201,000	5,465,000	5,358,000	4,878,000	5,723,000	3,811,000	2,628,000	223,000	55,369,000
		11,822	13,389	8,652	10,641	9,858	8,877	11,510	14,973	14,679	13,364	15,679	10,441	7,200	611	
	total rippable waste TPD (rippable waste)	9,860,000	9,457,000	4,323,000	3,248,000	2,376,000	2,663,000	1,706,000	443,000	553,000	999,000	175,000				35,803,000
		27,014	25,910	11,844	8,899	6,510	7,296	4,674	1,214	1,515	2,737	479				
	<b>balance TPD</b>	<b>38,836</b>	<b>39,299</b>	<b>20,496</b>	<b>19,540</b>	<b>16,367</b>	<b>16,173</b>	<b>16,184</b>	<b>16,186</b>	<b>16,195</b>	<b>16,101</b>	<b>16,159</b>	<b>10,441</b>	<b>7,200</b>	<b>611</b>	

**ORE HAULAGE AT MIRADOR**

	years == >	-1	1	2	3	4	5	6	7	8	9	10	11	12	13	total
	days/year == >	365	365	365	365	365	365	365	365	365	365	365	365	365	365	
<b>PHASE I</b>	upper working platform (masl) ==>	1,424	1,268	1,244	1,220	1,208	1,184	1,160	1,124							
	main road level (masl) ==>	1,340	1,340	1,340	1,340	1,340	1,340	1,340	1,340							
		84	-72	-96	-120	-132	-156	-180	-216							
in pit road distance (m)	8%	1,050	-900	-1,200	-1,500	-1,650	-1,950	-2,250	-2,700							
pit to crusher main road (m)	5% 1,340 1,232 down	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400							
total haulage bench to crusher (m)		3,450	3,300	3,600	3,900	4,050	4,350	4,650	5,100							
<b>Ore (Drilled and blasted)</b>		2,099,602	7,025,000	8,167,749	5,625,514	4,697,132	4,053,814	4,070,619	2,553,421							38,292,851
<b>TPD</b>		5,752	19,247	22,377	15,412	12,869	11,106	11,152	6,996							
<b>PHASE II</b>	upper working platform (masl) ==>			1,412	1,304	1,268	1,244	1,220	1,196	1,148	1,112	1,088				
	main road level (masl) ==>			1,340	1,340	1,340	1,340	1,340	1,340	1,340	1,340	1,340				
				72	-36	-72	-96	-120	-144	-192	-228	-252				
in pit road distance (m)	8%			900	-480	-900	-1,200	-1,500	-1,800	-2,400	-2,850	-3,150				
pit to crusher main road (m)	5% 1,340 1,232 down			2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400				
total haulage bench to crusher (m)				3,300	2,880	3,300	3,600	3,900	4,200	4,800	5,250	5,550				
<b>Ore (Drilled and blasted)</b>				957,251	2,456,751	2,709,440	3,510,390	3,587,914	3,509,840	6,786,924	4,440,145	1,848,737				29,807,393
<b>TPD</b>				2,623	6,731	7,423	9,618	9,830	9,616	18,594	12,165	5,065				
<b>PHASE III</b>	upper working platform (masl) ==>			1,508	1,400	1,364	1,316	1,292	1,268	1,244	1,220	1,172	1,124	1,064	1,040	
	main road level (masl) ==>			1,340	1,340	1,340	1,340	1,340	1,340	1,340	1,340	1,340	1,340	1,340	1,340	
				168	60	24	-24	-48	-72	-96	-120	-168	-216	-276	-300	
in pit road distance (m)	8%			2,100	750	300	-300	-600	-900	-1,200	-1,500	-2,100	-2,700	-3,450	-3,750	
pit to crusher main road (m)	5% 1,340 1,232 down			2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	
total haulage bench to crusher (m)				4,500	3,150	2,700	2,700	3,000	3,300	3,600	3,900	4,500	5,100	5,850	6,150	
<b>Ore (Drilled and blasted)</b>				1,042,735	1,718,428	1,560,797	1,466,468	3,061,739	2,338,076	4,684,855	7,276,263	9,125,000	9,125,000	9,125,000	1,127,272	42,526,632
<b>TPD</b>				0	2,857	4,708	4,276	4,018	8,388	6,406	12,835	19,935	25,000	25,000	3,088	
<b>total ore</b>		<b>2,099,602</b>	<b>7,025,000</b>	<b>9,125,000</b>	<b>9,125,000</b>	<b>9,125,000</b>	<b>9,125,000</b>	<b>9,125,000</b>	<b>9,125,000</b>	<b>9,125,000</b>	<b>9,125,000</b>	<b>9,125,000</b>	<b>9,125,000</b>	<b>9,125,000</b>	<b>1,127,272</b>	<b>110,626,876</b>
<b>TPD</b>		5,752	19,247	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	3,088	
balance tpd		5,752	19,247	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	3,088	

Remarks:

Negative means uphill road

**LOADING AND HAULAGE COSTS AT MIRADOR (on ore)**

**Caterpillar Fleet Production and cost analysis March 2005**

**Dumpers (new brand)      CAT 785 C      (140 ton)**

Availavility      92%  
 Operator effc.      83%  
 Dumper cost      **110.82 \$/hour**

Acquisition value \$ 960,000			
possession cost \$/h		operating cost \$/h	
depreciatn.	11.92	fuel	35.7
interest	7.05	lubes.filtres	3.92
insurance	0.56	Tires	16.36
taxes	0.11	Repairs	25.2
		operator	10.0
subtotal	19.64	subtotal	91.18
total op. Cost (\$/hour)		110.82	

**F.E.L. (new brand)      CAT 994**

bucket      24.37 ton      Operator effc.      83%  
 passes      5      Availavility      92%  
 fill factor      90%      Excavator cost      **210.0 \$/hour**

Acquisition value \$			
possession cost \$/h		operating cost \$/h	
depreciatn.		fuel	
interest		lubes.filtres	
insurance		tires	
taxes		repairs	
		operator	15.0
subtotal	0	subtotal	15
total op. Cost (\$/hour)		15	

tonne/hour      \$/hour      \$/tonne

**Dozer D 10 (second hand)**      1,000      **175**      0.18  
 20,000 tonne/day

**Drill rig performance**      2,340 tonne/hour      cost included in D&B rock  
 46,800 tonne/day



## ROAD MAINTENANCE COSTS AND ANCILLARY EQUIPMENT COSTS AT THE MIRADOR PIT

BREAKDOWN OF LOCAL OPERATING COSTS (\$/hour)

March 2005

main items	IN PIT ROAD MAINTENANCE EQUIPMENT & COSTS						IN PIT ANCILLARY EQUIPMENT			
	GRADER CAT 140 G	DOZER (*) CAT D9	F.E.L. CAT D 966	TRUCK MACK	DRUM VIB. I.R.	WATER TRUCK	DOZER (*) CAT D9	EXCAVATOR CAT 330	LUB. TRUCK	TRAILER PLATF.
<b>Fuel</b>	5.21	10.5	8.68	2.00	4.77	2.00	10.5	15.48	2.00	2.00
<b>Lubes, oil &amp; filters</b>	3.61	5.13	6.68	0.61	2.49	0.61	5.13	10.19	0.61	0.61
<b>Tyres</b>	2.35	-----	3.12	0.97	1.61	0.97	-----	-----	0.97	0.97
<b>Repairs</b>	6.97	31.51	11.55	7.37	5.83	7.37	31.51	17.82	7.37	7.37
<b>Operator</b>	6.00	10.00	6.00	4.00	4.00	4.00	10	6.00	4.00	4.00
<b>sub total (\$/hour)</b>	24.14	57.14	36.03	14.95	18.7	14.95	57.14	49.49	14.95	14.95
<b>Capital cost</b>	16.15	48.91	23.78	6.81	8.53	6.81	48.91	21.09	6.81	6.81
<b>total</b>	40.29	106.05	59.81	21.76	27.23	21.76	106.05	70.58	21.76	21.76
<b>Unforeseen (%)</b> 10.0	4.03	10.61	5.98	2.18	2.72	2.18	10.61	7.06	2.18	2.18
<b>total (\$/hour)</b>	44.32	116.66	65.79	23.94	29.95	23.94	116.66	77.64	23.94	23.94
<b>Utilization</b>										
hours/shift	5.0	2.0	3.0	3.0	2.5	2.5	4.0	2.0	4.0	2.0
shifts/day										
hours/day	10.0	4.0	6.0	6.0	5.0	5.0	8.0	4.0	8.0	4.0
<b>Total cost (\$/day)</b>	443.19	466.62	394.75	143.62	149.77	119.68	933.24	310.55	191.49	95.74
<b>Cost \$/tonne rock</b>	<b>0.011</b>	<b>0.012</b>	<b>0.010</b>	<b>0.004</b>	<b>0.004</b>	<b>0.003</b>	<b>0.024</b>	<b>0.008</b>	<b>0.005</b>	<b>0.002</b>
<b>Averaged cost (\$/tonne rock)</b>	<b>0.043</b>						<b>0.039</b>			
<b>Qty. (units)</b>	2	2	1	2	1	1	(*) same	2	1	1

Averaged ore & waste exploited per day:      39,491      tonnes



**MAIN LABOUR LIST AT THE MIRADOR OPEN PIT PROJECT (two shifts per day)**

production year ==>	-1	1	2	3	4	5	6	7	8	9	10	11	12	13
<b>1.- EXPLOITATION (tonnes/day)</b>														
Ore	6,362	6,913	27,652	27,652	27,652	27,652	27,652	27,652	27,652	27,652	27,652	27,652	27,652	3,416
Drilled & blasted waste	13,076	14,809	9,570	11,770	10,903	9,818	12,730	16,561	16,236	14,782	17,342	11,548	7,964	676
Rippable waste	29,879	28,658	13,100	9,842	7,200	8,070	5,170	1,342	1,676	3,027	530			
Total rock (tonnes)	49,317	50,380	50,321	49,264	45,755	45,539	45,552	45,555	45,564	45,461	45,524	39,200	35,615	4,092
<b>2.- LOADING &amp; HAULING ORE AND WASTE</b>														
Dumpers CAT 785 operators	14	16	16	12	12	12	14	14	16	16	16	16	16	16
FEL CAT 994 operators	4	4	4	4	4	4	4	4	4	4	4	4	4	4
<b>total</b>	<b>18</b>	<b>20</b>	<b>20</b>	<b>16</b>	<b>16</b>	<b>16</b>	<b>18</b>	<b>18</b>	<b>20</b>	<b>20</b>	<b>20</b>	<b>20</b>	<b>20</b>	<b>20</b>
<b>3.- DRILLING &amp; BLASTING ORE &amp; WASTE</b>														
Drill rigs operator and blasters	8	8	8	8	8	8	8	8	8	8	8	8	8	8
<b>5.- RIPPABLE WASTE</b>														
Dozer CAT D-10 operator	4	4	2	2	2	2	2	2	2	2				
<b>5.- IN PIT ROADS MAINTENANCE</b>														
Grader CAT 140 operator	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Dozer CAT D9 operator (*)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
FEL CAT 966 operator	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Trucks MACK (14 m3) operator	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Drum vibrator I.R. operator	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Water truck operator	2	2	2	2	2	2	2	2	2	2	2	2	2	2
<b>total</b>	<b>12</b>	<b>12</b>	<b>12</b>	<b>12</b>	<b>12</b>	<b>12</b>	<b>12</b>	<b>12</b>	<b>12</b>	<b>12</b>	<b>12</b>	<b>12</b>	<b>12</b>	<b>12</b>
<b>6.- IN PIT ANCILLARY EQUIPMENT</b>														
(*) Dozer CAT D9 (same unit)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Excavator CAT 330 operator	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Lub truck operator	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Trailer platform operator	2	2	2	2	2	2	2	2	2	2	2	2	2	2
<b>total</b>	<b>6</b>	<b>6</b>	<b>6</b>	<b>6</b>	<b>6</b>	<b>6</b>	<b>6</b>	<b>6</b>	<b>6</b>	<b>6</b>	<b>6</b>	<b>6</b>	<b>6</b>	<b>6</b>
<b>7.- VEHICLES SUPERVISION &amp; EXPLOSIVES</b>														
Pick up truck: driven by supervisors														
Emulsion mixer truck	3	3	3	3	3	3	3	3	3	3	3	3	3	3
<b>8.- MECHANICS</b>														
	14	14	14	14	14	14	14	14	14	14	14	14	14	14
<b>9.- WAREHOUSE</b>														
	2	2	2	2	2	2	2	2	2	2	2	2	2	2
<b>10.- ADMIN. &amp; CAMP MAINTENANCE</b>														
	3	3	3	3	3	3	3	3	3	3	3	3	3	3
<b>11.- SUPERVISORS</b>														
	4	4	4	4	4	4	4	4	4	4	4	4	4	4
<b>12.- PIT SUPERINTENDENT</b>														
	1	1	1	1	1	1	1	1	1	1	1	1	1	1
<b>total</b>	<b>75</b>	<b>77</b>	<b>75</b>	<b>71</b>	<b>71</b>	<b>71</b>	<b>73</b>	<b>73</b>	<b>75</b>	<b>75</b>	<b>73</b>	<b>73</b>	<b>73</b>	<b>73</b>
<b>5% Estimated absenteeism</b>	<b>3.8</b>	<b>3.9</b>	<b>3.8</b>	<b>3.6</b>	<b>3.6</b>	<b>3.6</b>	<b>3.7</b>	<b>3.7</b>	<b>3.8</b>	<b>3.8</b>	<b>3.7</b>	<b>3.7</b>	<b>3.7</b>	<b>3.7</b>
<b>TOTAL LABOUR AT SITE</b>	<b>79</b>	<b>81</b>	<b>79</b>	<b>75</b>	<b>75</b>	<b>75</b>	<b>77</b>	<b>77</b>	<b>79</b>	<b>79</b>	<b>77</b>	<b>77</b>	<b>77</b>	<b>77</b>

## MAIN LABOUR COST AT THE MIRADOR PROJECT

	Qty	\$/person	Cost (\$/month)	
			total (\$)	total/group
<b>SUPERVISION</b>				
L&H supervisor	2	3,000	6,000	
D&B supervisor	2	3,000	6,000	
Tech. Asistant (production records)	1	1,800	1,800	
Pit superintendent	1	5,000	5,000	
Admin. Assistant (payments, social security)	1	1,800	1,800	20,600
<b>ROCK BLASTING</b>				
Blaster I	1	2,500	2,500	
Blaster II	2	1,500	3,000	5,500
<b>MECHANICS</b>				
Supervisor	1	3,000	3,000	
Electrician	1	2,000	2,000	
Hydraulic	1	2,000	2,000	
Mechanic	1	2,000	2,000	
Helpers	3	1,000	3,000	12,000
<b>OTHERS</b>				
At warehouse	1	1,200	1,200	
Camp maintenance	1	600	600	1,800
<b>Total</b>	<b>19</b>		<b>39,900</b>	<b>39,900</b>

### ROCK DRILLING

Operator cost of \$ 10.0 per hour included in drill rig hourly cost

### LOADING

Operator cost of \$ 15.0 per hour included in F.E.L. hourly cost

### HAULING

Operator cost of \$ 10.0 per hour included in Dumper hourly cost

### MAINTENANCE AND ANCILLARY EQUIPMENT IN PIT

Respective operator cost per hour included in hourly cost

### EXPLOSIVES

Emlsion mixer-truck and respective labor cost under monthly basis contract at fixed \$ 5,000 (3 men)

**LOADING AND HAUL TRUCK EQUIPMENT PRODUCTIVITIES AT THE MIRADOR OPEN PIT PROJECT**

<i>production year ==&gt;</i>	<b>-1</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>13</b>
<b>1.- EXPLOITATION (tonnes/day)</b>														
Ore	5,752	19,247	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	3,088
Drilled & blasted waste	11,822	13,389	8,652	10,641	9,858	8,877	11,510	14,973	14,679	13,364	15,679	10,441	7,200	611
Rippable waste	27,014	25,910	11,844	8,899	6,510	7,296	4,674	1,214	1,515	2,737	479	0	0	0
Total rock (tonnes)	44,588	58,545	45,496	44,540	41,367	41,173	41,184	41,186	41,195	41,101	41,159	35,441	32,200	3,699
<b>2.- LOADING &amp; HAULING PRODUCTIVITY</b>														
<b>Dumpers CAT 785 per year</b>	<b>7</b>	<b>8</b>	<b>8</b>	<b>6</b>	<b>6</b>	<b>6</b>	<b>7</b>	<b>7</b>	<b>8</b>	<b>8</b>	<b>8</b>	<b>8</b>	<b>8</b>	<b>8</b>
<b>hours/day</b>	<b>20</b>	<b>22</b>	<b>20</b>	<b>21</b>	<b>21</b>	<b>21</b>	<b>20</b>	<b>21</b>	<b>21</b>	<b>20</b>	<b>22</b>	<b>21</b>	<b>21</b>	<b>3</b>
<b>FEL CAT 994 per year</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>
<b>PHASE I</b>														
Haulage distance-ore (Km)	3.45	3.30	3.60	3.90	4.05	4.35	4.65	5.10						
Ore tonne/day	5,752	19,247	22,377	15,412	12,869	11,106	11,152	6,996						
Effective productivity (tonne/hour)	344	316	292	285	275	257	236	216						
Haulage distance-waste (Km)	3.20	2.10	2.40	2.70	2.85	3.15	3.45	3.90						
Waste (t/day)	38,836	39,299	7,666	3,622	3,701	2,751	1,970	337						
Effective productivity (tonne/hour)	314	313	318	310	298	276	252	229						
Total phase I (tonne/hour)	318	314	299	290	280	261	238	217						
<b>PHASE II</b>														
Haulage distance-ore (Km)			3.30	2.88	3.30	3.60	3.90	4.20	4.80	5.25	5.55			
Ore t/day			2,623	6,731	7,423	9,618	9,830	9,616	18,594	12,165	5,065			
Effective productivity (tonne/hour)			344	379	334	307	278	260	225	207	196			
Haulage distance-waste (Km)			4.20	1.65	2.10	2.40	2.70	3.00	3.60	4.05	4.35			
Waste (t/day)			9,036	9,197	5,764	4,934	4,537	4,570	8,351	2,099	888			
Effective productivity (tonne/hour)			249	431	369	336	301	279	239	218	207			
Total phase II (tonne/hour)			270	409	349	317	285	266	229	209	198			
<b>PHASE III</b>														
Haulage distance-ore (Km)			4.50	3.15	2.70	2.70	3.00	3.30	3.60	3.90	4.50	5.10	5.85	6.15
Ore t/day			0	2,857	4,708	4,276	4,018	8,388	6,406	12,835	19,935	25,000	25,000	3,088
Effective productivity (tonne/hour)				378	422	403	354	324	292	271	239	212	186	178
Haulage distance-waste (Km)			3.30	1.95	1.50	1.50	1.80	2.10	2.40	2.70	3.30	3.90	4.65	4.95
Waste (t/day)			3,795	6,721	6,901	8,488	9,677	11,279	7,844	14,003	15,271	10,441	7,200	611
Effective productivity (tonne/hour)			288	407	466	454	392	357	318	294	255	225	196	186
Total phase III (tonne/hour)			288	398	448	437	381	343	306	283	246	216	188	179
<b>Total three phases (tonne/hour)</b>	<b>318</b>	<b>333</b>	<b>288</b>	<b>345</b>	<b>336</b>	<b>320</b>	<b>291</b>	<b>170</b>	<b>251</b>	<b>252</b>	<b>237</b>	<b>216</b>	<b>189</b>	<b>180</b>

# ASSUMPTIONS TAKEN INTO ACCOUNT IN THE MAMUT'S BUDGETARY BID DATED APRIL 6/2005

## 1.- MAIN ROADS (remains the same as quote No. 1)

- The 1,340 level is the starting point at which both, the pit to crusher and pit to waste dump main roads are connected to.
- Pit to waste dump (\*):
  - 530.65 m from 1,328 to 1,352 masl (4.5 % gradient)
  - 671.41 m from 1,352 to 1,292 masl (8.9 % gradient)
  - total: 1,202.06 m (6.96 % gradient)
  - (\*) designed by AMEC
- Pit to crusher (JC proposal): 2,400 m from 1,340 to 1,232 masl (4.5 % gradient) This road is about to link the pit to waste dump road at 1,340 masl
- Gradients are averaged values at two ends of roads
- In pit road, from 1,340 upwards to 1,580 at 8 % gradient; and from 1,340 downwards to 1,040 at 8 % will get access to benches located in between
- Turnouts are supposed to be included in total road distance.

## 2.- ROCK

- All ripplable waste located above 1,580 masl is supposed to be pushed downhill by bulldozer and loaded at 1,580
- All ore is drilled and blasted at 50% ANFO, 50 % Emulsion
- Density: Ore in bench = 2.65 loose = 1.6  
Waste in bench = 2.55 loose = 1.54 (e)

## 3.- MAIN EQUIPMENT

- **8 Caterpillar 785 C dumpers (140 tonnes)** and 2 Caterpillar 994 FEL (19.88 m<sup>3</sup>) were chosen for hauling and loading rock
- Respective acquisition costs based on NO formal quote.

### FEL 994 OPEX IS AN AVERAGED VALUE FROM CAT HANDBOOK

- Dumper 785 opex based on local statistics and local CAT dealer suggestions
- Fuel price equals to 1.05 \$/gal
- Operator's salary for both FEL and dumper are included in hourly cost
- 1 Drill rig for 203 mm hole. (Tricone bit) opex included in D&B rock
- 1 Emulsion mixer-truck. Opex included in D&B rock.

Ancillary equipment, opex included:

2 x Grader 1 x Dozer D-9 2 x FEL 966 2 x Excavator 330  
2 x 20 ton Truck 1 x water-truck 1 x drum vib. 1 x Lub truck  
1 x trailer platform

#### **4.- CAPEX AND OPEX NO TAKEN INTO ACCOUNT**

- NO capital expenditure for any road construction has been included, nor for aggregates for road maintenance
- NO opex for waste dump construction is estimated
- NO opex for clearing and rubbing is included
- NO expenses for topography nor for grade control.

#### **5.- LOADING & HAULING COST ESTIMATION**

- Carried out by the Caterpillar software, Fleet Production and Cost at local CAT dealer in Guayaquil. Major input values are:
- Two shifts of 12 hours each, being 10 hours effective working time.
- Shift utilization = 83 %                      **Effective days per year = 365**
- FEL filling factor = 90 %                      FEL & Dumpers availability = 92 %
- FEL passes per truck = 5                      Net load per truck = 138 tonnes

#### **6.- CAPEX FOR INFRASTRUCTURE**

- Estimation was done for camp construction, warehouse, explosives storage, fuel tanks, water supply and first medical aid at site

#### **7.- IMPROVEMENTS AT PROPOSED BID**

##### **Roads**

- A detailed main roads design keeping grades as low as possible has to be done. It will allow dumpers to increase performance. Otherwise, dumper's velocity is highly penalized in calculations
- Refilling with waste from pit, placed in certain sections of roads, could be usefull.

##### **Dumpers and FEL's (It has been done already)**

- New boxes to get **140** tonnes net load per dumper was considered. This demands FEL's 5 bucket passes to fill a dumper.

##### **Working days per year**

- 365days



## Memo

To **Tom Nikiforuk** File No. **142314**  
From **Mark Pearson** cc **G. Frost, AMEC**  
Tel  
Fax  
Date **8 April 2005**

Subject **Mirador Project – Mamut Revised Mining Proposal**

Both Gord and I have had a look through the proposal, and have the following comments:

1. Trucks and loaders appear to be reasonable, in regards to expected productivities.
2. The truck fleet has been based on 150 t trucks. By the BC mines act (probably different for Ecuador) the running surface for the road should be 3x the truck width or 19 m. Overall the design was done at 18 m, so it fairly close.
3. The drilling was stated to be a 203 mm drill, where the workbook has 127 mm drills stated.
4. Explosives use is based on a 50/50 blend of ANFO / Emulsion. AMEC had finalized on 70/30. Depending on the amount used, and the differences in price between ANFO and Emulsion, there may be opportunity to lower the costs.
5. There is only one D9 in the estimate, and two D10s. Budget pricing has been based on utilization of 1 D9 and anywhere from 0 to 1.4 D10s. We both believe that either you have to beef up the D9 fleet (add a second dozer), or make use of the D10 (probably the best way to go). In our planning we had used two dozers for wall control (as opposed to drilling and blasting the perimeter)
6. There is an allowance for only one grader onsite. Graders are notorious for being the last vehicles to be fixed as they tend to be regarded as a cost to the operation. At the end of the day they move nothing, so the loaders, trucks, drills, and dozers get fixed first (probably in that order). As a result they tend to have a very low mechanical availability. It is why AMEC have always put two as a minimum into an estimate.
7. The labour list appears to only list the labour on site. As an example, they have listed 16 haulage truck drivers for 8 trucks. If the operation is going 24-7 then four crews will be required, and all the trucks manned. This would then total up to 32 haulage truck drivers (with a mechanical availability of 85% then 28 total drivers required).
8. We will need to make sure that there are costs within the model to allow for sufficient Corriente staff (engineering and geology, mining) to run the operation.

9. We will also need to make sure that there is an allowance for dewatering of the walls and the pits

I would believe that if this is going to form the basis of the costs for the feasibility study, and be used to go to a bank, that Mirador should get as much back up to this cost estimate as they can.

cheers

Mark

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**Mirador Waste Dump Design  
Final Report**

Submitted to:

**Corriente Resources Inc.**  
Vancouver, B.C.

Submitted by:

**AMEC Earth & Environmental,  
a division of AMEC Americas Limited**

Burnaby, BC

27 April 2005

AMEC File: VM00343-600

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#### **IMPORTANT NOTICE**

This report was prepared exclusively for Corriente Resources Inc. by AMEC Earth & Environmental, a wholly owned subsidiary of AMEC Earth & Environmental a division of AMEC Americas. The quality of information, conclusions and estimates contained herein is consistent with the level of effort involved in AMEC services and based on: i) information available at the time of preparation, ii) data supplied by outside sources, and iii) the assumptions, conditions and qualifications set forth in this report. This report is intended to be used by Corriente Resources Inc. only, subject to the terms and conditions of its contract with AMEC. Any other use of, or reliance on, this report by any third party is at that party's sole risk.

## 1.0 OVERVIEW

At the Mirador mine site, the waste dump must be constructed to contain both saprolite and waste rock stripped from pit development. The mine schedule indicates that up to half of the waste material could be saprolite, although this volume also includes the highly weathered, but more competent saprolite rock. The mine schedule also includes inferred waste. It has been assumed that approximately one third of the total saprolite tonnage indicated in the table below is competent saprolitic rock. A combined overall dry density of 2 t/m<sup>3</sup> has been assumed for the materials.

**Table 1.1: Mine Plan Schedule**

Year	Waste - Saprolite	Waste - Sulphide	Waste - Inferred	Total	Waste - Saprolite	Waste - Sulphide	Waste - Inferred	Total
	t	t	t	t	m <sup>3</sup>	m <sup>3</sup>	m <sup>3</sup>	m <sup>3</sup>
YEAR -1	9,859,990	3,908,009	407,367	14,175,367	3,286,663	3,597,336	203,684	7,087,683
YEAR 1	9,457,305	4,170,691	716,448	14,344,443	3,152,435	3,661,563	358,224	7,172,222
YEAR 2	4,322,909	2,315,119	842,225	7,480,252	1,440,970	1,878,044	421,112	3,740,126
YEAR 3	3,247,706	3,351,567	533,051	7,132,324	1,082,569	2,217,068	266,526	3,566,162
YEAR 4	2,376,511	3,208,883	387,902	5,973,295	792,170	2,000,526	193,951	2,986,648
YEAR 5	2,663,302	2,803,991	436,198	5,903,491	887,767	1,845,879	218,099	2,951,746
YEAR 6	1,706,029	3,430,527	769,786	5,906,342	568,676	1,999,602	384,893	2,953,171
YEAR 7	442,642	5,052,720	412,686	5,908,048	147,547	2,600,134	206,343	2,954,024
YEAR 8	552,803	4,556,202	800,978	5,909,983	184,268	2,370,235	400,489	2,954,991
YEAR 9	999,174	4,096,813	780,746	5,876,733	333,058	2,214,935	390,373	2,938,366
YEAR 10	175,088	4,057,600	1,665,392	5,898,080	58,363	2,057,981	832,696	2,949,040
YEAR 11	0	2,233,444	1,578,189	3,811,633	0	1,116,722	789,095	1,905,817
YEAR 12	0	2,178,355	450,360	2,628,715	0	1,089,177	225,180	1,314,358
YEAR 13	0	208,698	14,148	222,846	0	104,349	7,074	111,423

There is little information known about the foundation conditions at the waste dump site. Saprolite and saprolitic rock vary in depth throughout the area. Mapping information suggests that reasonably competent rock may exist in portions of the creek bottoms, but saprolite is expected to dominate the dump foundations. A streambed walk-through indicated that there is a colluvium layer overlying saprolite which is underlain by weathered rock.

The saprolite characteristics have been estimated from published information. There could be considerable variations from these estimated values which may be non-conservative. A summary of some of the key observations in each of the papers reviewed is contained in Appendix A. A summary of these key characteristics is presented below:

- Engineering properties are influenced by the rock type;
- Contains micro and macro voids which influence strength and permeability;
- Relict structure will affect directional shear strength (may be important in foundation);

- Excavation and compaction tend to break down particles and change gradational, index and compaction properties;
- Most in situ saprolites behave like an overconsolidated soil. Loads increased beyond a threshold stress will result in increased compressibility and settlement.
- Pore pressures are usually low due to high void ratios resulting in moderately high permeability. Pore pressure reduction under high load are generally rapid;
- Small scale strength tests may over estimate shear strength;
- Engineering properties will vary greatly over short distance;
- Drying and wetting of saprolite will change the compaction and index properties.

Assumptions regarding construction of the dump included the following:

- The dump will be segmented, with the upper one third of the dump volume nearest the crusher consisting of saprolite, saprolitic rock and highly weathered rock, and the lower two thirds of the dump consisting of the majority of broken, but competent waste rock from the pit excavation.
- Diversions will be constructed upslope of the dump to divert surface runoff.
- Flow thru drains will be incorporated into the dump design. The drains will be constructed using competent clean rock fill waste from the open pit. The drains will be placed in lifts in the natural drainage valleys within the dump footprint. These will assist in draining the dump and will provide drainage for seepage water and unintercepted surface flow along the existing stream channels.
- The foundations below the competent waste rock are expected to be stripped of all organic materials, loose soils and saprolite. Construction of the dump will consist of phased stripping and excavating down to a sound foundation within the footprint of the waste rock area. Only a limited amount of stripping should be completed in advance of dump placement as to not expose the foundation to precipitation and traffic. It has been assumed that the portion of the dump beneath the saprolite will not be stripped.
- The saprolite and saprolitic rock is assumed to be placed in engineered lifts and compacted. No foundation preparation is anticipated; however, clearing of trees and shrubs should be completed.
- Saprolite and competent waste will be placed starting at the interface between the two materials. The dump material would be placed working upslope with the saprolite and downslope with rock from the interface. The dump should be constructed using horizontal lifts across the small valleys previously infilled with clean competent waste (flow thru drains). The stability analyses provide some guidelines for limiting heights and widths to maintain stability during the different years of operation.
- Minimum height lifts are expected to be placed over the foundation, and, depending upon response, the lift heights will then be adjusted. Bottom up construction will be necessary for the saprolite portion of the dump. The basic premise is to place and compact a minimal height of saprolite, then start building the waste rock berm downstream – similar, to how a dam would be constructed. The saprolite will be retained by the waste rock which will act as a stabilizing berm.

## 2.0 STABILITY ANALYSES

Two-dimensional limit equilibrium analyses were carried out using SLOPE/W and the Morgenstern-Price (1965) method of solution. Circular failures, using both the grid and radius option, as well as specified sliding surfaces were used in the analysis. The section analysed traverses the length of the dump and through its highest point. This was considered the most critical in terms of stability. The configurations for Year 1, 4, 8 and 13 are shown in Drawings 1 and 2. The following analyses were carried out:

- Analyses of various heights (1250m, 1300m and 1350m) of saprolite cumulative waste volumes. The required depth and height of the competent waste rock dump were determined based on achieving a minimum factor of safety of 1.2 to 1.3.
- The strength values for the colluvium and organics under the saprolite layer were varied to determine the impact on stability for the geometries approximated for Year 1 and 13.
- Analyses of the effect of the height of the water table on the factor of safety were conducted for each stage (approximately Year 1, 4, 8 and 13) of the waste dump.

### Material and Properties

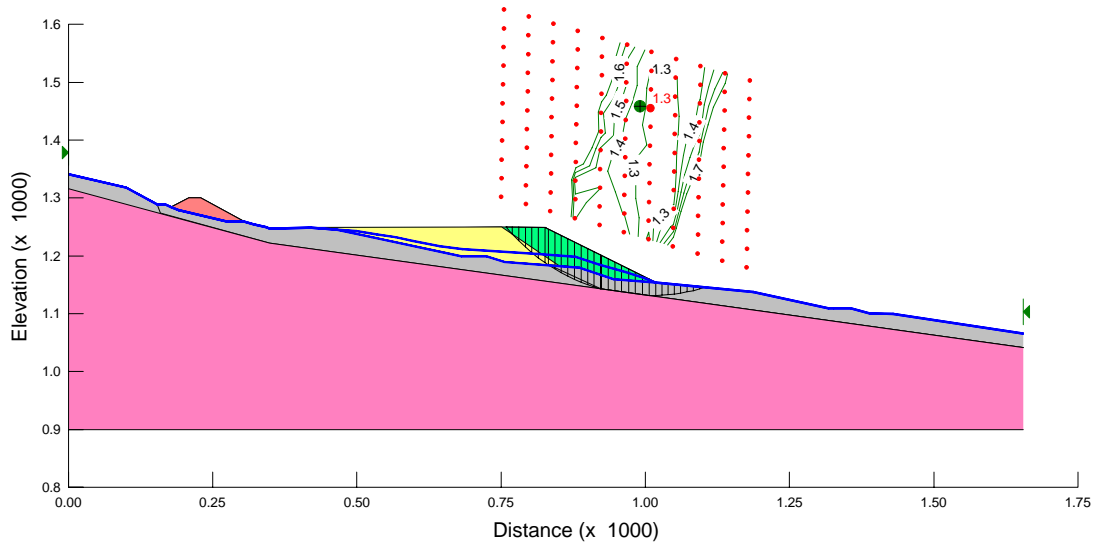
**Table 2.1: Material Properties For Analysis**

Material Description	Bulk Unit Weight $\gamma$ (kN/m <sup>3</sup> )	Pore Pressure Conditions	Effective Friction Angle $\phi'$ (degrees)
Waste Rock	21	Moderate water Table	35
Compacted Saprolite	19	$R_u = 0.2$ to $0.3$	30
Road	19	Free Draining-zero	33
Foundation Colluvium and Organics (under Saprolite Dump)	18	Hydrostatic below inferred water table (at surface)	10, 20, 25
Foundation Saprolite	19	Hydrostatic below inferred water table (at surface)	30

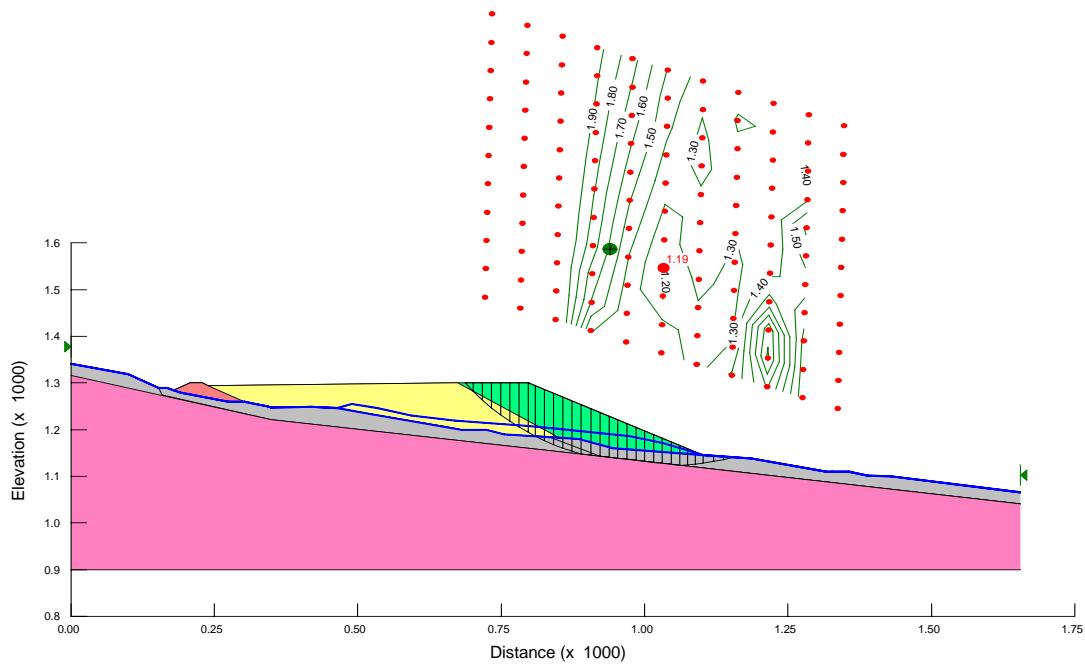
Note: Assume  $c'=0$  for all materials

The downstream slope of the compacted saprolite was assumed to be at 1.5H:1V and the downstream slope of the waste rock was assumed to be at 2.5H:1V. The phreatic surface in the foundation was estimated conservatively at original ground surface. The phreatic surface in the competent waste was estimated and a  $R_u$  value of 0.3 was used for the compacted saprolite. In order to achieve a minimum factor of safety of 1.2 to 1.3, the following waste rock widths were determined from the stability analyses at different stages of construction:

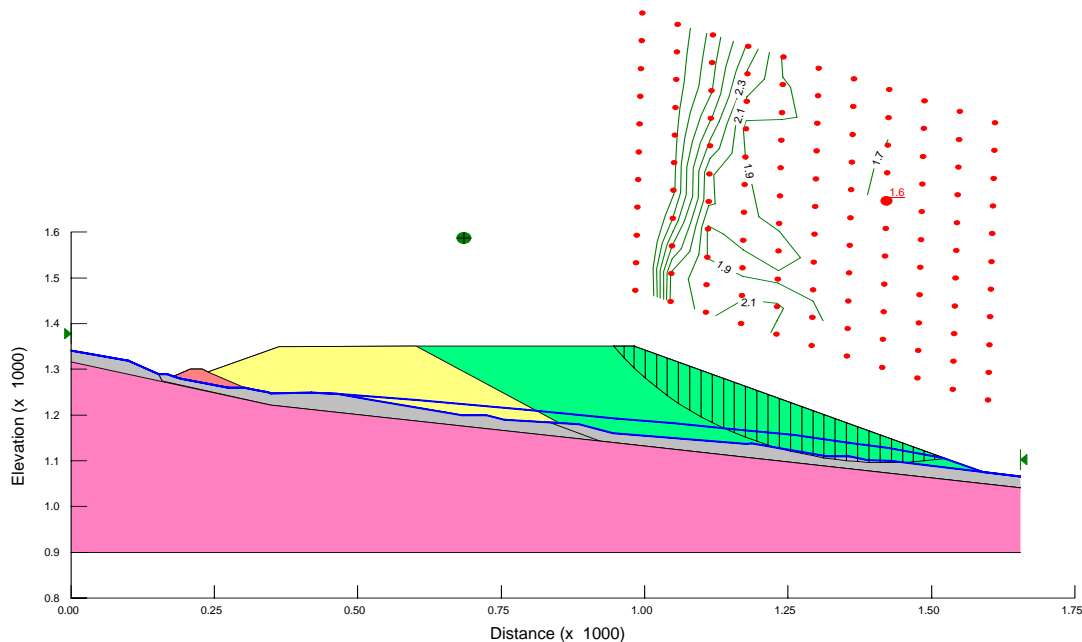
- For a saprolite waste elevation of 1250, the downstream waste rock dump must be at least 75m wide (at the same elevation and assuming competent foundation conditions) as shown in Figure 2.1.
- At 1300m, the downstream waste rock dump must be at least 125m wide (Figure 2.2).
- At 1350m, the downstream waste rock dump must be at least 200m wide (Figure 2.3).



**Figure 2.1: Waste Dump at 1250m**



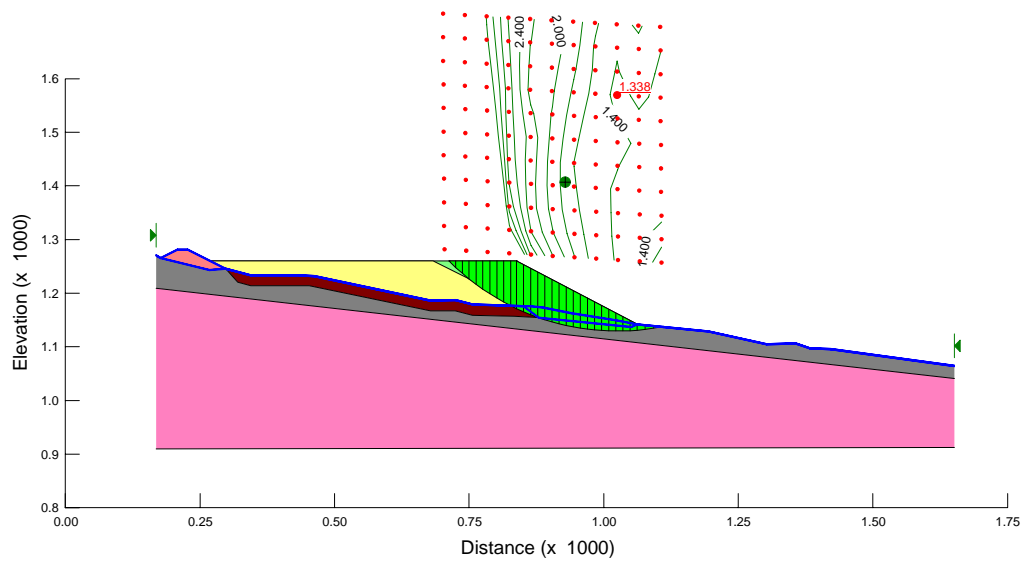
**Figure 2.2: Waste Dump at 1300m**



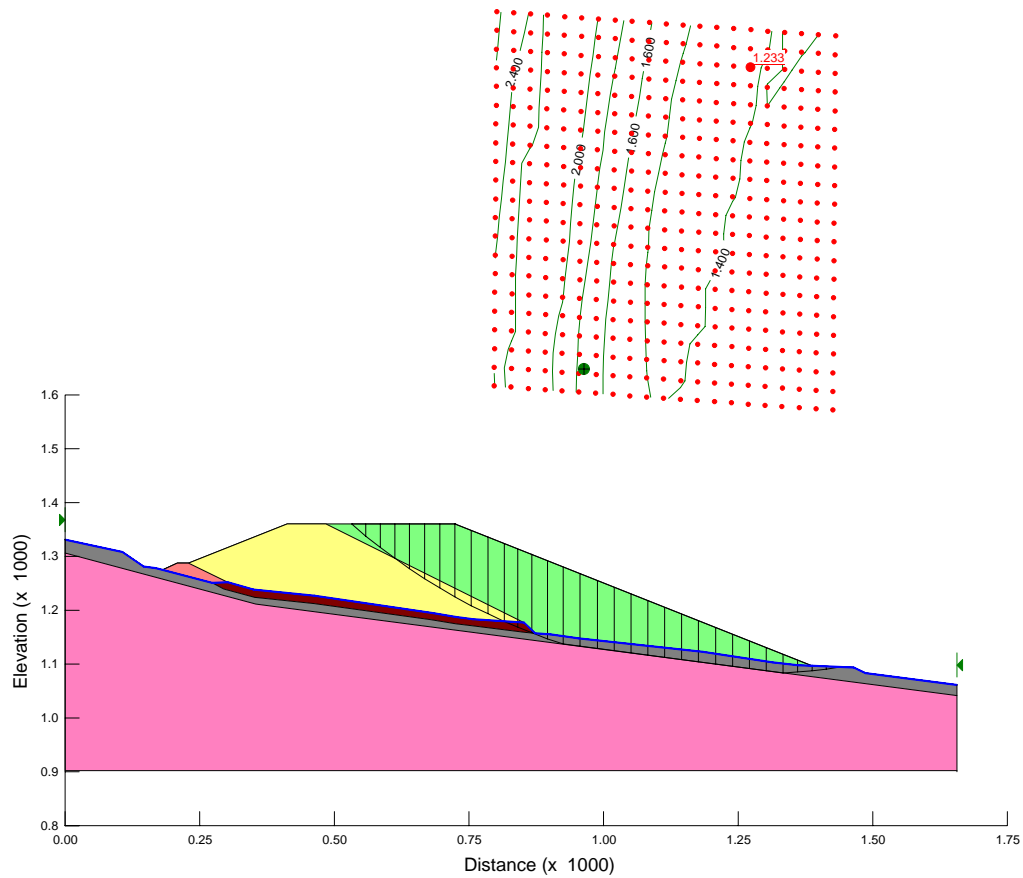
**Figure 2.3: Waste Dump at 1350m**

A second analysis was run assuming a 20m thick layer of colluvium and organics beneath the compacted saprolite. This layer was assumed to be stripped beneath the waste rock. The downstream slope of the compacted saprolite was taken as 2:1. The downstream slope of the waste rock was taken as 2:1 for Year 1 and 2.5:1 for the other years.  $R_u$  for the compacted saprolite was taken as 0.2. The properties of the organics layer were varied between 10 and 25 degrees to observe the effect on the factor of safety. The results are summarised below:

- For the dump at Year 1, there was little effect on the critical factor of safety for the critical surface (1.34 to 1.35). The critical failure surface was through the toe of the dump as shown in Figure 2.4.
- For the dump at Year 13, the factor of safety dropped from 1.3 to 1.2 (Figure 2.5). To increase the factor of safety of the final dump, it is recommended that the material at the toe of the dump be excavated and replaced. However, the extent (or even need) for this will have to be determined once more information is known about the foundation conditions.
- If the material was not stripped from the surface below the waste rock (ie green portion), then the factors of safety drop below unity.

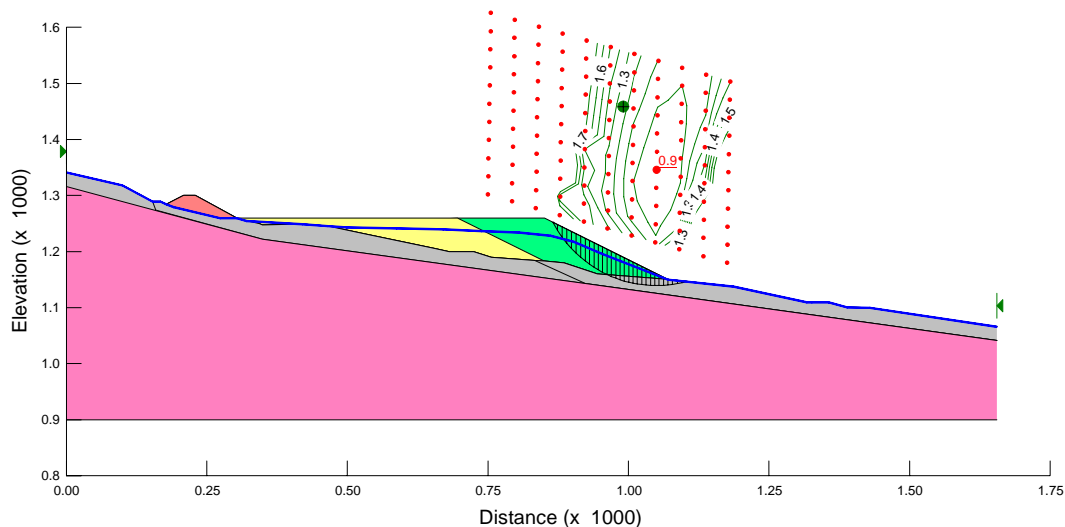


**Figure 2.4: Waste Dump at ~Year 1**



**Figure 2.5: Waste Dump at ~Year 13**

A third analysis was run and the height of the water table in the waste rock was varied. As with the analyses discussed above, the downstream slope of the compacted saprolite was taken as 2:1 and the downstream slope of the waste rock was taken as 2:1 for Year 1 and 2.5:1 for the other years.  $R_u$  for the compacted saprolite was taken as 0.2. The lowest water table was inferred to be at the top of the foundation saprolite. For each stage of construction (approximately Year 1, 4, 8 and 13) lowering the water table resulted in a higher factor of safety. The factor of safety ranged from 0.9 to 1.1 with a high water table to 1.3 to 1.8 with the water table just above the foundation saprolite (Figure 2.6).



**Figure 2.6: Waste Dump at ~Year 1 with high water table**

The geometry of the SlopeW analyses sections approximate different stages of the waste dump. From the revised volumes on the October 19, 2004 Mining Schedule, the configurations approximate Year 1, 4, 8 and 13. The topography of the area has also been revised and has uniformly changed by an increase of 10 metres. The geometry of the sections has not changed and the analyses are still valid.

It should be noted that these results are based on inferred depths and properties of the foundation materials. Further investigations of foundation conditions at the waste dump are required prior to final design to determine the foundation properties and pore pressure conditions. The field investigation should include:

- Test pits to observe the fabric of the foundation saprolite (relic discontinuity orientations).
- Boreholes to determine depths and properties of the foundation saprolite.
- Field load tests to determine pore pressure reaction of the foundation saprolite to loading.
- The possibility of mineralogy work and Xray diffraction for clay mineralogy could also be considered.

### 3.0 CONSTRUCTION SEQUENCING

Construction sequencing for the waste dump will consist of the following:

- Identification of a hard/competent rock borrow source for the flow through drains and road surfacing in saprolite.
- Construction of the flow through drains in down slope lifts along the valley bottoms.
- Stripping of organics and soft soil from the foundation of the competent waste rock dump. Organics and poor saprolite to be placed in alternating lifts with competent saprolite within the saprolite dump area. (i.e, one horizontal lift of competent saprolite across the dump lift, the next lift upslope should comprise of a 2:1 ratio of competent saprolite to organic waste, again to be placed the width of the dump. The next upslope lift will comprise of competent saprolite only etc.).
- Placement of saprolite in 0.5m high compacted lifts within the saprolite dump footprint. Use the observational approach to determine optimal lift heights.
- Sequenced placement of the competent rock below the saprolite toe is required for buttressing and overall stability of the dump. The saprolite foundation should be stripped immediately prior to waste placement. The extent of exposure will need to be determined in the field using the observational approach.

Dump construction for the saprolite should commence at the saprolite/competent rock interface and work up slope, while the competent rock dump area should work down slope as clearing of the foundation has been completed. The bottom edge of the cleared foundation should be free draining.

#### **Construction Assumptions**

- Assume no stripping required for the saprolite dump foundation;
- Stripping of organics and loose soils required in the competent waste dump foundation prior to placement;
- Assume saprolite can be satisfactorily compacted in lifts using haul truck and bulldozer equipment.
- Assume all drainage south of the Crusher access road has been intercepted and diverted away from the dump area.
- Assume dump construction utilising a series of wrap around dump lifts from main access road. Lift placement should consist of a single lift over the required dump footprint before advancing to additional lifts.

#### 4.0 LIMITATIONS AND CLOSURE

Recommendations presented herein are based on a geotechnical evaluation of the findings of the site investigation noted. If conditions other than those reported are noted during subsequent phases of the project, AMEC should be notified and be given the opportunity to review and revise the current recommendations, if necessary. Recommendations presented herein may not be valid if an adequate level of review or inspection is not provided during construction.

This report has been prepared for the exclusive use of Corriente Resources Inc. for specific application to the area within this report. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibility of such third parties. AMEC accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report. It has been prepared in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied, is made.


Respectfully submitted,

**AMEC Earth & Environmental,  
a division of AMEC Americas Limited**

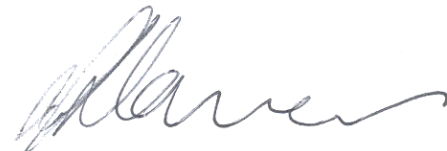
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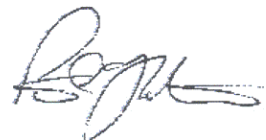
Joyce C. Chen, E.I.T.  
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Vancouver Geotechnical  
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D.S. (Drum) Cavers, M.Eng., P.Eng., P.Geo.  
Principal Engineer

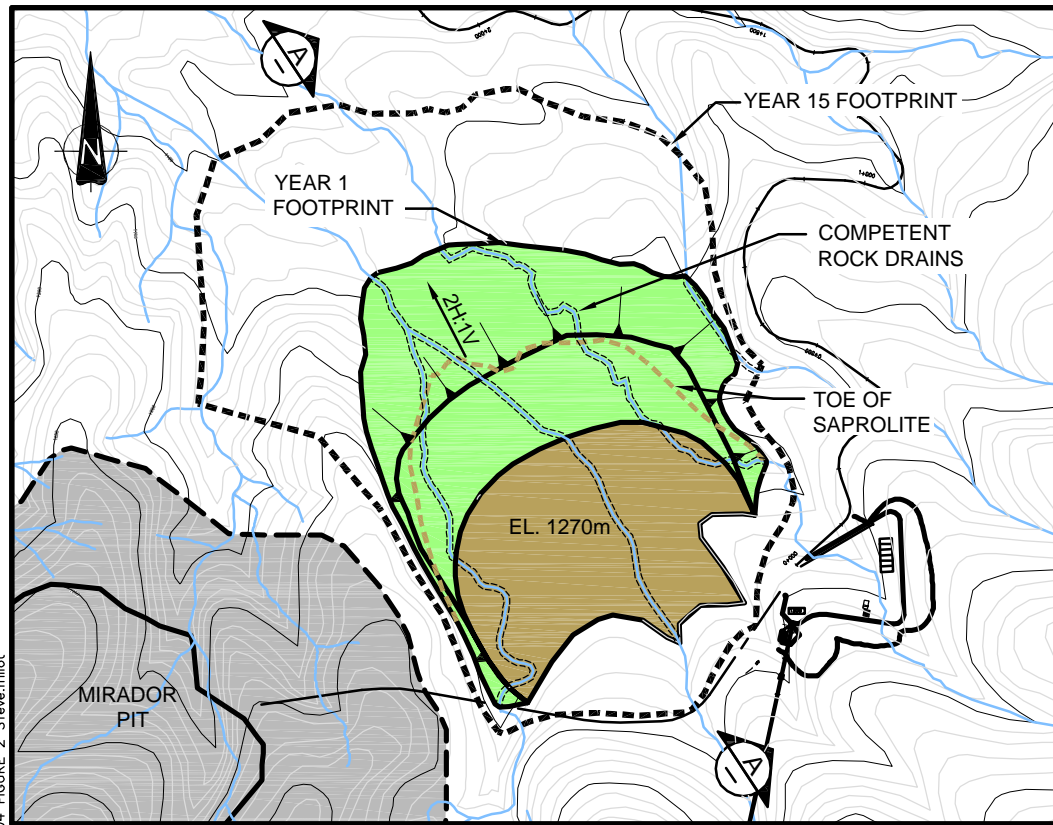


Peter C. Lighthall, P.Eng.  
Vice-President, Mining

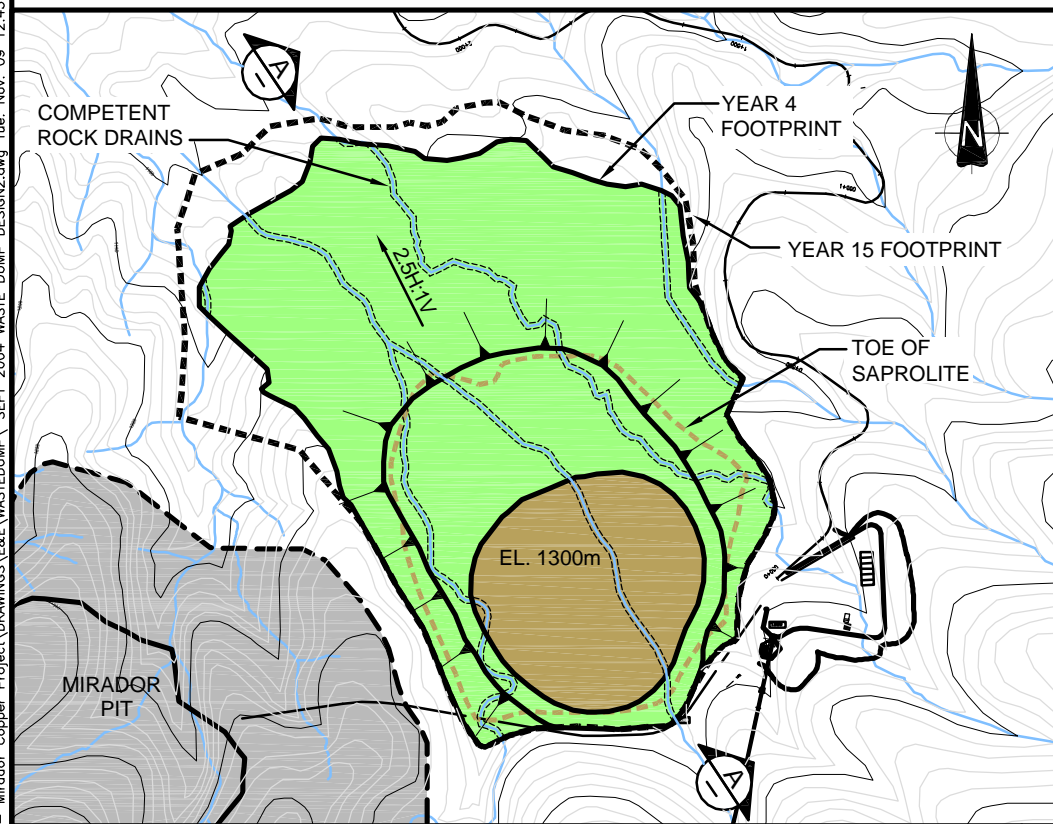
List of Attachments:

- Drawing 1 – Mirador Waste Dump Conceptual Plan and Sections Year 1 and Year 4
- Drawing 2 – Mirador Waste Dump Conceptual Plan and Sections Year 8 and Year 13
- Appendix A – Summary of Engineering Properties of Saprolite

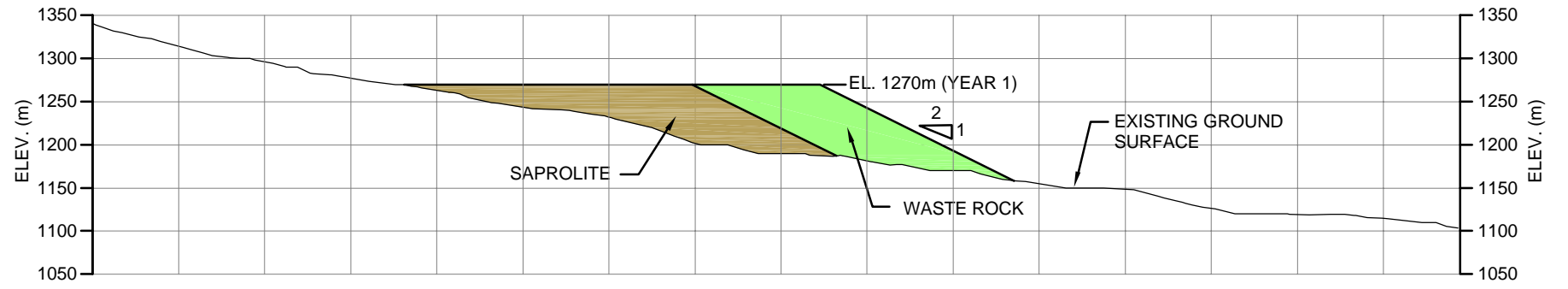
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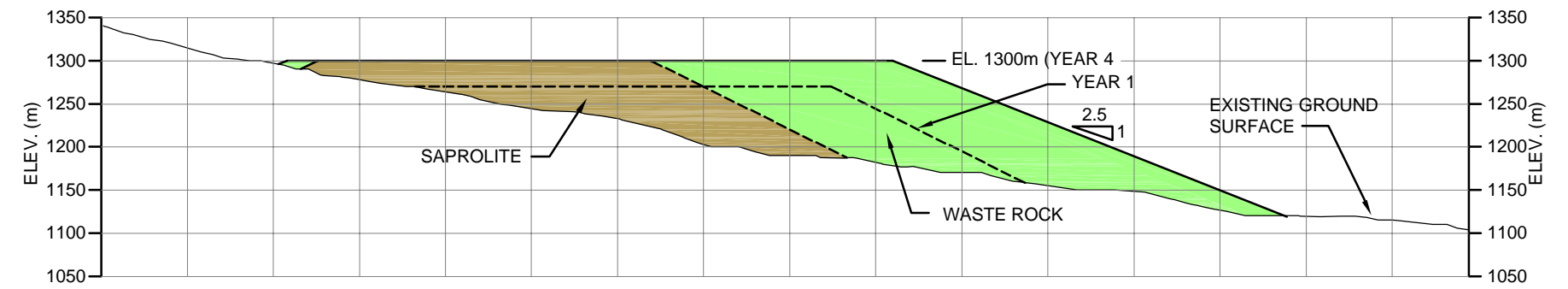
**YEAR 1 FOOTPRINT**



**YEAR 4 FOOTPRINT**



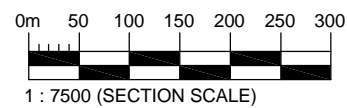
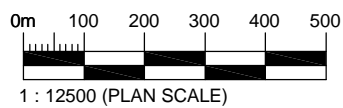
**YEAR 1 SECTION A-A**



**YEAR 4 SECTION A-A**

**NOTES:**

1. STRIPPING OF ORGANICS AND LOOSE FOUNDATION SOILS TO BE COMPLETED UNDER THE DUMP FOOTPRINT.
2. COMPETENT ROCK TO BE PLACED IN CREEK VALLEYS AND ADVANCED PRIOR TO WASTE PLACEMENT.
3. THE SAPROLITE DUMP HEIGHT SHOULD NOT EXCEED THE COMPETENT WASTE DUMP BY MORE THAN 5 M.
4. OBSERVATIONAL APPROACH USED TO REFINE WASTE DUMP STABILITY AND WASTE MANAGEMENT.



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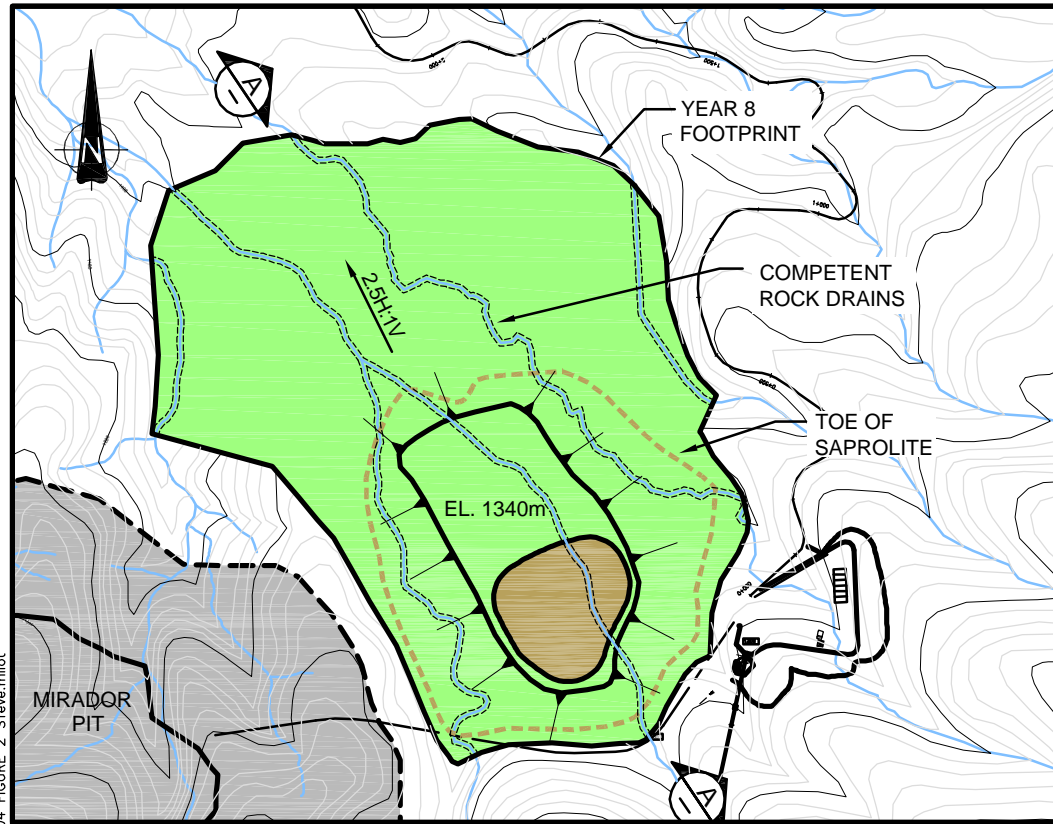
**CORRIENTE RESOURCES INC.**

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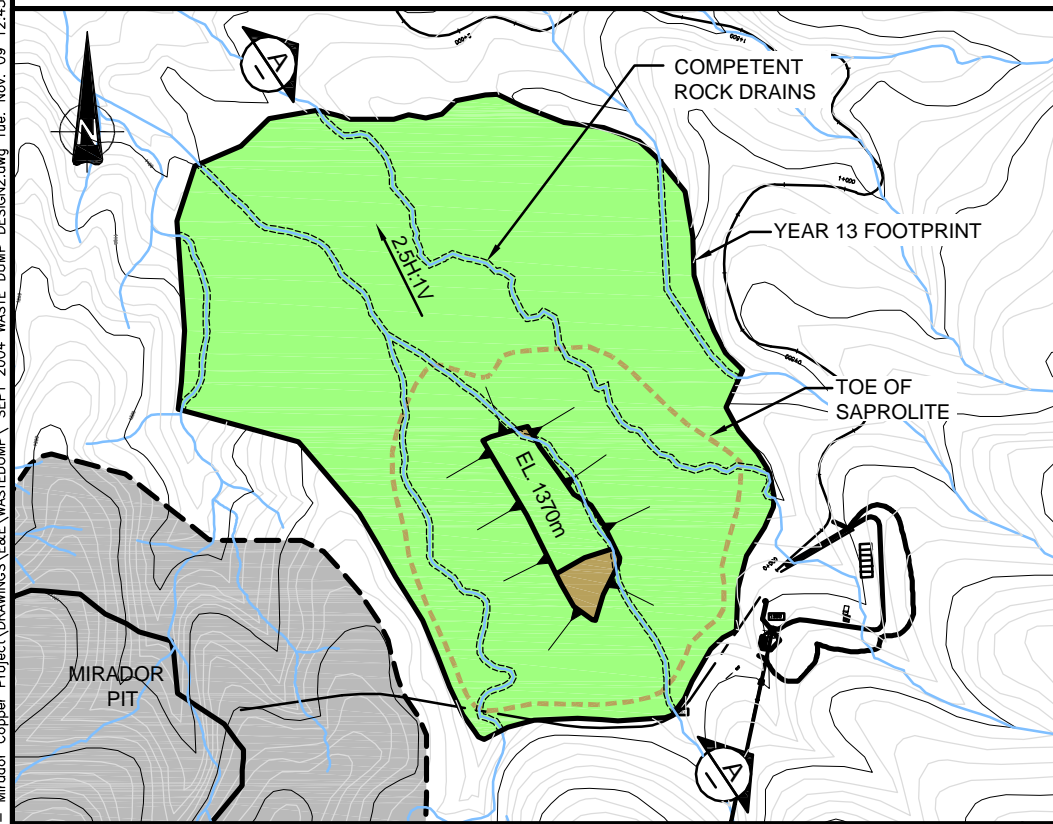
**MIRADOR WASTE DUMP  
 CONCEPTUAL PLAN AND SECTIONS  
 YEAR 1 AND YEAR 4**

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PROJECT NO:	VM00343
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DRAWING No.	<b>DRAWING 1</b>

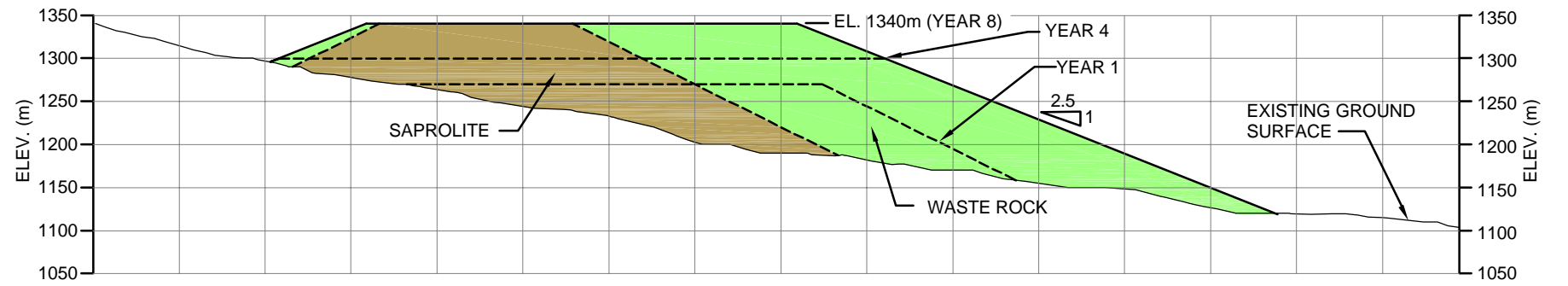
PLOT 1:1-D S:\PROJECTS\VM000343 - Mirador Copper Project\Drawings\&E\WASTEDUMP\SEPT 2004\WASTE\_DUMP\_DESIGN.dwg Tue, Nov 09 12:45pm 2004 FIGURE 2 STIve.milot



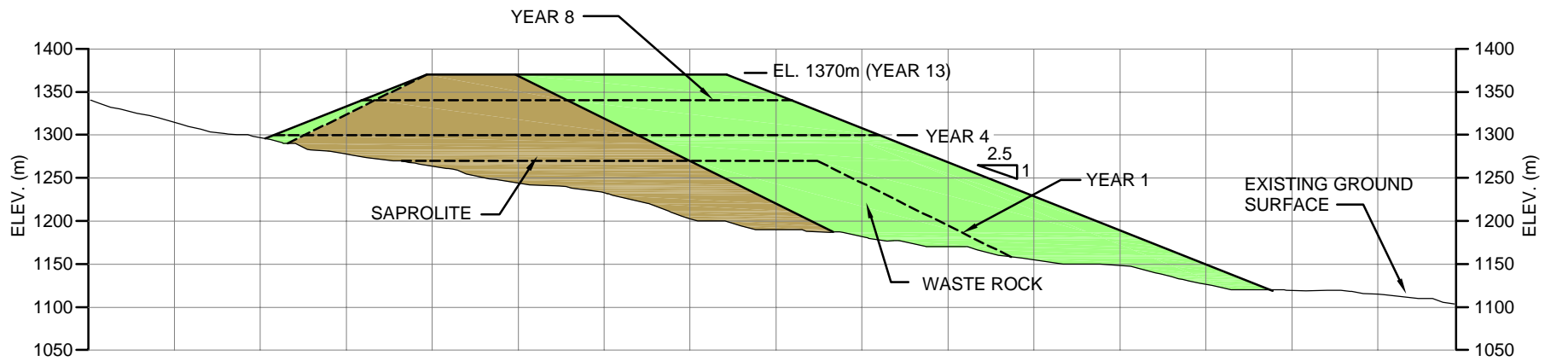
**YEAR 8 FOOTPRINT**



**YEAR 13 FOOTPRINT**



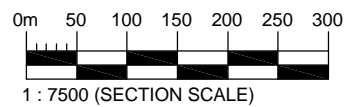
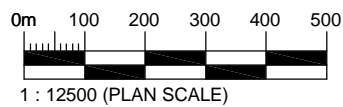
**YEAR 8 SECTION A-A**



**YEAR 13 SECTION A-A**

**NOTES:**

1. STRIPPING OF ORGANICS AND LOOSE FOUNDATION SOILS TO BE COMPLETED UNDER THE DUMP FOOTPRINT.
2. COMPETENT ROCK TO BE PLACED IN CREEK VALLEYS AND ADVANCED PRIOR TO WASTE PLACEMENT.
3. THE SAPROLITE DUMP HEIGHT SHOULD NOT EXCEED THE COMPETENT WASTE DUMP BY MORE THAT 5 M.
4. OBSERVATIONAL APPROACH USED TO REFINE WASTE DUMP STABILITY AND WASTE MANAGEMENT.



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 SCALE: AS SHOWN

**MIRADOR WASTE DUMP  
 CONCEPTUAL PLAN AND SECTIONS  
 YEAR 8 AND YEAR 13**

DATE: APRIL 2005  
 PROJECT NO: VM00343  
 REV. NO.:  
 DRAWING No. **DRAWING 2**

**APPENDIX A**  
**Summary of Engineering Properties of Saprolite**

## PRIVILEGED AND CONFIDENTIAL

### SUMMARY OF ENGINEERING PROPERTIES OF SAPROLITE (from preliminary literature review)

- ◆ The engineering properties of saprolite are influenced by the type of original rock that has become weathered *ie* granite, gneiss, sandstone, micaceous *etc.*
- ◆ Saprolite frequently contains micro and macro voids which influence shear strength and permeability.
- ◆ The presence of relict structure may influence directional shear strength.
- x ◆ The weathered aggregate in the material is subject to crushing at moderate stress. Feldspar and microceous grains weather most readily and are subject to crushing and particle bond collapse at low stress.
- ◆ Excavation and compaction tend to break down the particles and change the gradation, index and compaction properties.
- ◆ Most insitu saprolites behave as if they were over-consolidated. When the load is increased to a "threshold stress", compressibility and settlement increase greatly. This is sometimes referred to as collapsing. This can lead to serious differential settlement with associated cracking. If hydrostatic pressure exceeds the confining stress the cracking can be extended by hydraulic fracturing.
- ◆ Pore pressures are usually low due to the high void ratio. Pore pressure reduction under load application is usually rapid.
- ◆ Small scale strength tests may overestimate the shear strength.
- ◆ The engineering properties frequently vary greatly over short distances. The degree of weathering is also variable. Hence, sample selection for testing is very important.
- ◆ Drying or wetting of the residual material will usually change the index properties and compaction properties.

Please call (604) 922-3717 if you did not receive all pages.

**SUMMARY NOTES RE PAPERS ON RESIDUAL SOILS PARTICULARLY SAPROLITES** (papers attached)

**The characterization of granite saprolite soils (Reference 1)**

**Saprolite** - A term to describe that portion of the weathering profile which has retained the original rock fabric and structure, but is a soil in terms of consistency and strength. (1)

**Laterite** - The top most zone of the weathering profile which has lost all the original rock fabric.

**Design Assessment of Saprolite and Laterites (Reference 2)**

Particles of tropical soil often consist of aggregates of weathered mineral matter that leak down and become progressively finer if the soil is manipulated.

The permeability of tropical soils is usually governed by its micro and macro fabric and by superimposed features such as slickensiding, termite or other biochannels. For this reason the design assessment of tropical soils require far more attention to visually describable features of the soil profile, selection of insitu and laboratory test methods and particularly to the scale on which such tests are performed.

It is almost essential, in saprolite profiles to visually and tactically explore the soil profile via test holes. In South Africa the soil is exposed via large diameter 750 - 1000mm borehole holes in which a person descends in a bosuns chair.

Description should include moisture content, color, consistency and strength, structure or fabric, soil type and rock type from which the soil originated.

Most residual saprolites and laterites behave as if over-consolidated. The A value is usually positive but small. Pore pressures generated by undrained shear strength are usually unimportant and may often be ignored in analysis.

Many authors have concluded that the strength of most saprolites may be governed almost entirely by their inherited fabric and structural features. Small scale strength tests may over-estimate the soil mass strength.

All residual soils behave as if over consolidated. Compressibility is relatively low at low stress levels. Once a threshold yield stress or pseudo - consolidation stress has been exceeded, the compressibility increases. Yield stress usually does not correlate well with either depth or initial void ratio. Big variations may occur over a relatively small vertical distance. SPT tests, large scale field compressibility tests and pressuremeter tests can give acceptably accurate settlement values.

The degree of weathering is variable. Therefore sample selection is a major problem to be representative. Good control of quality in compacted fills may be extremely difficult to achieve. Considerable variation in gradation.

Drying of the soil from its initial insitu water content may change both the index and compaction properties. Hence, soil samples have to be treated with the greatest care if the results of compaction tests are to be at all meaningful. The compaction characteristics of residual soils may be very dependent on the method of compaction.

Permeability of saprolite controlled by relict structure. Presence of biochannels may be missed during site investigations which can represent a difficult repair problem. Lab tests on undisturbed samples are usually too small.

### **The Compressibility of Undisturbed and Comparison of Residual Soils at Guri - Guyana region of Venezuela (Reference 3)**

Important thicknesses of highly porous soils with a stiff bonded structure. The compressibility and collapse characteristics of these soils are difficult to predict because of extreme lectyrogenity and testing difficulties of stiff bonded soils.

Accurate predictions of magnitude and time of foundation settlements needed for realistic evaluation of cracking potential of high dam structures.

Guri saprolite shows a rigid bonded structure probably caused by re-cementation of iron salts and by the proper relict structure of the rock. Clay content decreases with depth.

Large differences between compressibility of "dry loaded" and "flooded" specimens. Under flooded conditions the material appears to be highly compressible and many of the "dry loaded" experiments showed evidence of collapse when wetted under significant vertical loads.

Soil behaves in a stiff manner until a certain "threshold stress" is attained. After this load is exceeded the soil starts to compress significantly. After the "threshold stress" has been exceeded the soil follows an almost linear relationship between strain and logarithm of vertical stress. It is reasoned that the "threshold stress" corresponds to the pressure at which the initial stiff bonded structure of the soil and the cemented macro particles are crushed.

Guri dam - essentially homogeneous compacted saprolite gneiss. Specs required pre-wetting to +1 to -2% of standard proctor optimum and placed to dry densities above 98% standard proctor. These criteria were met in the field. (Note. Compacting to Modified proctor may yield very brittle material which will crack due to moderate differential settlement.)

\* Remolded saprolite does not retain the collapse and contractive characteristics of parent saprolite.

Test data from the dam shows that each stratum of the foundation behaves in a very stiff manner until a certain additional load is applied. After this pressure is exceeded, the saprolite starts to compress significantly in a manner similar to a normally consolidated soil. Some indications of a metastable behavior have been detected. Deeper layers require larger additional vertical pressures for this yield to occur.

The "threshold stress" varies between 3.0 and 6.0 kg/cm<sup>2</sup> for Guri soils.

Large diameter constant stress Ratio triaxial tests and especially Ko triaxial tests closely predicted the magnitude of the vertical strains. However CSR triaxial tests fail to predict the "yield stress" whereas the Ko results do show this discontinuity in behavior.

#### Properties of Compacted Granite Saprolites (Reference 4)

Viewed under stereoscopic magnifying glass and petrographic microscope.

X-ray diffraction - quartz, micabiotite, feldspar and clay - montmorillonite, Kaolinite and mica.

High uniformity coefficient, - tested for filter criteria - placed 5mm circular hole in specimen - confining pressure 3.0 Kg/cm<sup>2</sup>. Observed outflow after.

Initially permeability coefficients decreased with time. When hydraulic head increased quickly permeability coefficient increased quickly. For this, fine particles near the hole were dragged out. There was a sudden coloring of water after increase in hydraulic head. Particles dragged smaller than 0.15mm. Triaxial compression tests with particles less than 10mm. on statically compacted tests  $\gamma$  1.76 - 1.94 g/cm<sup>3</sup>  $c$  - 0.2 to 1.1 Kg/cm<sup>2</sup>  $\phi$  - 35 - 39°

High compressibility of samples leads to large decrease in void ratio during consolidation phase of triaxial test which increases maximum deviation stress.

For hydraulic gradient of 15  $k = 3 \times 10^{-6}$  cm/sec  
 For hydraulic gradient of 100  $k = 2 \times 10^{-4}$  cm/sec  
 and interval erosion occurred.

\* Conclusion - normal filter criteria could not be applied for this tested material.

$$6.0 \frac{\text{kg}}{\text{cm}^2} \times 9.81 \frac{\text{m}}{\text{s}^2} = 58.8 \frac{\text{kg m}}{\text{s}^2 \text{cm}^2} = 58.8 \frac{\text{N}}{\text{cm}^2} \times \frac{100 \times 100 \text{ cm}}{\text{m}^2} = 588,000 \frac{\text{N}}{\text{m}^2} = 588 \frac{\text{kN}}{\text{m}^2}$$

### **Fabric and Engineering Properties of Saprolites and Laterites (Reference 5)**

Another important factor to influence the geotechnical behavior of residual soils is the presence of a weakly bonded structure, a component of strength and stiffness which is independent of effective stress and porosity and which behaves as if it is due to physical connection between particles.

Bonding generally associated with -

- ◆ the presence of a true cohesion in terms of effective stress.
- ◆ presence of an "apparent pre-consolidation pressure" indicative of yield unrelated to stress history or density.
- ◆ a stiff response at low stresses and a more plastic behavior at larger stresses, characterizing a yield surface.

It is clear that the engineering properties of residual soils are greatly influenced by the microstructure associated with the weathering process. This includes:

- ◆ structural anisotropy associated with the parent rock (schist, phyllite, gneiss, granite).
- ◆ presence of relict structure.
- ◆ fissures, soils or other discontinuities.
- ◆ holes associated with laterization pressures, animal action, internal erosion of softer zones leading to higher mass permeability.
- ◆ Recommend study of thin sections to evaluate grain distribution.
- ◆ Inspect for presence of iron oxides.
- ◆ In the material tested where unsaturated samples lost their brittleness suggests that first order bonding in this gneissic material would be destroyed by changes in isotropic effective stresses above 75 Kpa.

Quartz grains are chemically stable, however, feldspar and micas in gneissic materials show a different sequence of alteration.

Shear strengths for different saprolite soils from metamorphic rocks.

Ferritic quartzite	- C = 20 - 50 Kpa	$\phi = 37 - 44^\circ$
Schist	- C = 78 - 100 Kpa	$\phi = 27 - 28^\circ$
Phyllite	- C = 10 - 60 Kpa	$\phi = 29 - 41^\circ$
Micaceous	- C = 40 - 45 Kpa	$\phi = 22 - 27^\circ$

- ◆ Recommend thin section analysis plus scanning electron microscopy.

### Design Assessment of Lateritic and Saprolite Soils (Reference 6)

- ◆ The combined influence of differing weathering and different parent rock give rise to widely differing mineralogy and granulometry with widely varying proportions of fully altered material.
- ◆ The effect of weathering and drying under tropical conditions assumes great importance. It is possible that repeated wetting and drying can either increase or decrease the strength.
- ◆ Degree of saturation plays an important role in effecting the shear strength. The deformations that may occur due to saturation can be critical in some cases. Collapse behavior of decomposed gneiss and other saprolite soils has been reported.

The presence of macro pores and channels associated with the laterization process are important in controlling flow through these materials.

- ◆ In feldspar rich saprolitic soils, fracturing of weathered feldspar grains seems to occur at low stress levels.
- ◆ Several indications that the structure of a saprolitic soil is of a collapsed nature has been observed during the microscopic study such as sheared and distorted mica booklets... Volume reduction in quartz grains - weathered vs unweathered has been grossly estimated at about 10 - 20%.
- ◆ From the three main minerals that constitute gneissic rocks feldspars are the most sensitive - to progressive softening.
- ◆ There are several cases in residual soils originated from gneiss, granite etc, in which the strength measurements in the laboratory or small scale field tests, under-estimate the real mass strength.

### **Problem Prevention for Embankment Dams on Saprolite (Reference 7)**

In tropical climates, laterite and saprolite soils often present difficult engineering problems.

There appears to be a distinct increase in permeability with depth and the nature and strength of the cementation of this material also vary. In areas where weathering has preceded to significant depths, seepage control could require difficult remedial measures. Low densities and weakly cemented structure could also pose long term deformation problems.

- ◆ Leaching tests should also be included.

For seepage control consider:-

- ◆ reservoir water losses
- ◆ pore pressure in embankment of dam
- ◆ pore pressures in foundation and abutments
- ◆ control of seepage gradients - prevent hydraulic piping

Special potential problems:

- ◆ leaching potential of residual materials
- ◆ effective compaction of plastic materials in extremely wet environment
- ◆ changes in gradation and engineering properties during excavation and compaction
- ◆ variation in permeability and nature and strength of cementation in saprolite
- ◆ material processing requirements for core, filters, shells and rip rap in residual materials.

**MINING SCHEDULE Year -1 to Year 7**

Corriente Mirador Mining Schedule: Revised October 19, 2004 : V1.3A

	YEAR -1	YEAR 1 (1Q)	YEAR 1 (2Q)	YEAR 1 (3Q)	YEAR 1 (4Q)	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	PAGE TOTAL
<b>Phase One Starter Pit</b>													
Waste - Saprolite	9,859,990	3,483,345	2,426,525	2,393,261	1,154,173	<b>9,457,305</b>	1,202,968	288,932	231,082	89,350			<b>21,129,627</b>
Waste - Sulphide	3,908,009	1,274,962	749,641	740,744	1,405,344	<b>4,170,691</b>	1,101,582	767,888	897,542	713,006	616,742	122,834	<b>12,298,293</b>
Waste - Inferred	407,367	190,449	176,044	204,027	145,928	<b>716,448</b>	492,615	265,106	222,281	202,017	101,763		<b>2,407,596</b>
Waste - Inferred - Cu%	0.589	0.687	0.745	0.685	0.707	<b>0.705</b>	0.741	0.624	0.687	0.711	0.720		<b>0.683</b>
Waste - Inferred - Au g/t	0.225	0.226	0.228	0.224	0.227	<b>0.226</b>	0.221	0.207	0.239	0.242	0.286		<b>0.228</b>
Waste - Total	14,175,367	4,948,756	3,352,210	3,338,032	2,705,445	<b>14,344,443</b>	2,797,165	1,321,925	1,350,905	1,004,372	718,505	122,834	<b>35,835,517</b>
Ore	2,099,602	181,648	2,281,250	2,281,250	2,281,250	<b>7,025,398</b>	8,167,749	5,625,514	4,697,132	4,053,814	4,070,619	2,553,421	<b>38,293,249</b>
Ore - Cu%	0.661	0.638	0.656	0.775	0.805	<b>0.742</b>	0.777	0.736	0.755	0.767	0.759	0.756	<b>0.751</b>
Ore - Au g/t	0.223	0.225	0.230	0.228	0.223	<b>0.227</b>	0.228	0.242	0.251	0.255	0.245	0.289	<b>0.241</b>
<b>Total Phase One</b>	<b>16,274,969</b>	<b>5,130,404</b>	<b>5,633,460</b>	<b>5,619,282</b>	<b>4,986,695</b>	<b>21,369,841</b>	<b>10,964,914</b>	<b>6,947,439</b>	<b>6,048,037</b>	<b>5,058,186</b>	<b>4,789,124</b>	<b>2,676,255</b>	<b>74,128,766</b>
<b>Phase Two Intermediate Pit</b>													
Waste - Saprolite							1,763,240	1,812,827	1,072,309	923,776	422,460	111,058	<b>6,105,669</b>
Waste - Sulphide							1,185,092	1,356,425	955,788	679,068	770,638	1,267,131	<b>6,214,141</b>
Waste - Inferred							349,610	188,408	75,553	198,497	462,636	290,235	<b>1,564,939</b>
Waste - Inferred - Cu%							0.457	0.522	0.547	0.521	0.499	0.513	<b>0.500</b>
Waste - Inferred - Au g/t							0.172	0.271	0.214	0.176	0.203	0.149	<b>0.191</b>
Waste - Total							3,297,941	3,357,659	2,103,650	1,801,340	1,655,734	1,668,425	<b>13,884,749</b>
Ore							957,251	2,456,751	2,709,440	3,510,390	3,587,914	3,509,840	<b>16,731,587</b>
Ore - Cu%							0.636	0.614	0.627	0.629	0.603	0.604	<b>0.616</b>
Ore - Au g/t							0.228	0.233	0.218	0.186	0.191	0.197	<b>0.204</b>
<b>Total Phase Two</b>							<b>4,255,192</b>	<b>5,814,411</b>	<b>4,813,090</b>	<b>5,311,730</b>	<b>5,243,648</b>	<b>5,178,265</b>	<b>30,616,336</b>
<b>Phase Three Ultimate Pit</b>													
Waste - Saprolite							1,356,701	1,145,947	1,073,120	1,650,177	1,283,569	331,584	<b>6,841,097</b>
Waste - Sulphide							28,445	1,227,254	1,355,553	1,411,918	2,043,148	3,662,755	<b>9,729,072</b>
Waste - Inferred								79,538	90,068	35,684	205,387	122,451	<b>533,128</b>
Waste - Inferred - Cu%								0.524	0.529	0.369	0.566	0.563	<b>0.540</b>
Waste - Inferred - Au g/t								0.200	0.205	0.248	0.201	0.155	<b>0.194</b>
Waste - Total							1,385,146	2,452,739	2,518,741	3,097,779	3,532,103	4,116,789	<b>17,103,298</b>
Ore								1,042,735	1,718,428	1,560,797	1,466,468	3,061,739	<b>8,850,166</b>
Ore - Cu%								0.557	0.664	0.587	0.612	0.622	<b>0.615</b>
Ore - Au g/t								0.216	0.250	0.288	0.285	0.241	<b>0.256</b>
<b>Total Phase Three</b>							<b>1,385,146</b>	<b>3,495,474</b>	<b>4,237,169</b>	<b>4,658,576</b>	<b>4,998,571</b>	<b>7,178,528</b>	<b>25,953,464</b>
<b>Total - Inpit</b>													
Waste - Saprolite	9,859,990	3,483,345	2,426,525	2,393,261	1,154,173	<b>9,457,305</b>	4,322,909	3,247,706	2,376,511	2,663,302	1,706,029	442,642	<b>34,076,394</b>
Waste - Sulphide	3,908,009	1,274,962	749,641	740,744	1,405,344	<b>4,170,691</b>	2,315,119	3,351,567	3,208,883	2,803,991	3,430,527	5,052,720	<b>28,241,507</b>
Waste - Inferred	407,367	190,449	176,044	204,027	145,928	<b>716,448</b>	842,225	533,051	387,902	436,198	769,786	412,686	<b>4,505,663</b>
Waste - Inferred - Cu%	0.589	0.687	0.745	0.685	0.707	<b>0.705</b>	0.623	0.573	0.623	0.597	0.546	0.528	<b>0.603</b>
Waste - Inferred - Au g/t	0.225	0.226	0.228	0.224	0.227	<b>0.226</b>	0.201	0.228	0.226	0.212	0.214	0.151	<b>0.211</b>
Waste - Total	14,175,367	4,948,756	3,352,210	3,338,032	2,705,445	<b>14,344,443</b>	7,480,252	7,132,324	5,973,295	5,903,491	5,906,342	5,908,048	<b>66,823,564</b>
Ore	2,099,602	181,648	2,281,250	2,281,250	2,281,250	<b>7,025,398</b>	9,125,000	9,125,000	9,125,000	9,125,000	9,125,000	9,125,000	<b>63,875,002</b>
Ore - Cu%	0.661	0.638	0.656	0.775	0.805	<b>0.742</b>	0.762	0.683	0.700	0.683	0.674	0.652	<b>0.697</b>
Ore - Au g/t	0.223	0.225	0.230	0.228	0.223	<b>0.227</b>	0.228	0.236	0.241	0.234	0.230	0.237	<b>0.233</b>
<b>Total INPIT</b>	<b>16,274,969</b>	<b>5,130,404</b>	<b>5,633,460</b>	<b>5,619,282</b>	<b>4,986,695</b>	<b>21,369,841</b>	<b>16,605,253</b>	<b>16,257,324</b>	<b>15,098,296</b>	<b>15,028,492</b>	<b>15,031,343</b>	<b>15,033,048</b>	<b>130,698,566</b>
<b>Expit</b>													
Dam Construction													
Road Construction													
Sediment Control Construction													
Other Construction													
Year -1 Stockpile Transfer to Yr 1, Q1		2,099,602				<b>2,099,602</b>							<b>2,099,602</b>
<b>Total Expit</b>		<b>2,099,602</b>				<b>2,099,602</b>							<b>2,099,602</b>
<b>TOTAL - INPIT &amp; EXPIT</b>													
Waste - Saprolite	9,859,990	3,483,345	2,426,525	2,393,261	1,154,173	<b>9,457,305</b>	4,322,909	3,247,706	2,376,511	2,663,302	1,706,029	442,642	<b>34,076,394</b>
Waste - Sulphide	3,908,009	1,274,962	749,641	740,744	1,405,344	<b>4,170,691</b>	2,315,119	3,351,567	3,208,883	2,803,991	3,430,527	5,052,720	<b>28,241,507</b>
Waste - Inferred	407,367	190,449	176,044	204,027	145,928	<b>716,448</b>	842,225	533,051	387,902	436,198	769,786	412,686	<b>4,505,663</b>
Waste - Total	14,175,367	4,948,756	3,352,210	3,338,032	2,705,445	<b>14,344,443</b>	7,480,252	7,132,324	5,973,295	5,903,491	5,906,342	5,908,048	<b>66,823,564</b>
Ore	2,099,602	181,648	2,281,250	2,281,250	2,281,250	<b>7,025,398</b>	9,125,000	9,125,000	9,125,000	9,125,000	9,125,000	9,125,000	<b>63,875,002</b>
Waste - Expit Construction													
Year -1 Stockpile Transfer to Yr 1, Q1													
<b>TOTAL</b>	<b>16,274,969</b>	<b>5,130,404</b>	<b>5,633,460</b>	<b>5,619,282</b>	<b>4,986,695</b>	<b>21,369,841</b>	<b>16,605,253</b>	<b>16,257,324</b>	<b>15,098,296</b>	<b>15,028,492</b>	<b>15,031,343</b>	<b>15,033,048</b>	<b>130,698,566</b>

**MINING SCHEDULE Year 8 to Year 13**

Corriente Mirador Mining Schedule: Revised October 19, 2004 : V1.3A

	YEAR 8	YEAR 9	YEAR 10	YEAR 11	YEAR 12	YEAR 13	YEAR 14	YEAR 15	YEAR 16	YEAR 17	YEAR 18	YEAR 19	PAGE TOTAL	TOTAL
<b>Phase One Starter Pit</b>														
Waste - Saprolite														21,129,627
Waste - Sulphide														12,298,293
Waste - Inferred														2,407,596
Waste - Inferred - Cu%														0.683
Waste - Inferred - Au g/t														0.228
Waste - Total														35,835,517
Ore														38,293,249
Ore - Cu%														0.751
Ore - Au g/t														0.241
<b>Total Phase One</b>														<b>74,128,766</b>
<b>Phase Two Intermediate Pit</b>														
Waste - Saprolite	38,138												38,138	6,143,808
Waste - Sulphide	2,348,696	662,204	323,990										3,334,890	9,549,031
Waste - Inferred	661,367	104,143											765,510	2,330,448
Waste - Inferred - Cu%	0.584	0.704											0.601	0.533
Waste - Inferred - Au g/t	0.179	0.270											0.192	0.191
Waste - Total	3,048,201	766,347	323,990										4,138,538	18,023,288
Ore	6,786,924	4,440,145	1,848,737										13,075,806	29,807,393
Ore - Cu%	0.624	0.689	0.718										0.659	0.635
Ore - Au g/t	0.204	0.224	0.272										0.220	0.211
<b>Total Phase Two</b>	<b>9,835,125</b>	<b>5,206,492</b>	<b>2,172,727</b>										<b>17,214,344</b>	<b>47,830,680</b>
<b>Phase Three Ultimate Pit</b>														
Waste - Saprolite	514,664	999,174	175,088										1,688,926	8,530,023
Waste - Sulphide	2,207,507	3,434,609	3,733,609	2,233,444	2,178,355	208,698							13,996,222	23,725,295
Waste - Inferred	139,611	676,603	1,665,392	1,578,189	450,360	14,148							4,524,303	5,057,431
Waste - Inferred - Cu%	0.458	0.442	0.418	0.466	0.494	0.801							0.448	0.458
Waste - Inferred - Au g/t	0.135	0.141	0.145	0.185	0.193	0.143							0.163	0.166
Waste - Total	2,861,782	5,110,386	5,574,089	3,811,633	2,628,715	222,846							20,209,451	37,312,749
Ore	2,338,076	4,684,855	7,276,263	9,125,000	9,125,000	1,127,272							33,676,466	42,526,632
Ore - Cu%	0.588	0.607	0.615	0.608	0.631	0.724							0.618	0.617
Ore - Au g/t	0.179	0.177	0.177	0.184	0.187	0.203							0.182	0.198
<b>Total Phase Three</b>	<b>5,199,858</b>	<b>9,795,241</b>	<b>12,850,352</b>	<b>12,936,634</b>	<b>11,753,715</b>	<b>1,350,118</b>							<b>53,885,918</b>	<b>79,839,381</b>
<b>Total - Inpit</b>														
Waste - Saprolite	552,803	999,174	175,088										1,727,064	35,803,458
Waste - Sulphide	4,556,202	4,096,813	4,057,600	2,233,444	2,178,355	208,698							17,331,112	45,572,619
Waste - Inferred	800,978	780,746	1,665,392	1,578,189	450,360	14,148							5,289,813	9,795,476
Waste - Inferred - Cu%	0.562	0.477	0.418	0.466	0.494	0.801							0.470	0.531
Waste - Inferred - Au g/t	0.171	0.158	0.145	0.185	0.193	0.143							0.167	0.187
Waste - Total	5,909,983	5,876,733	5,898,080	3,811,633	2,628,715	222,846							24,347,990	91,171,553
Ore	9,125,000	9,125,000	9,125,000	9,125,000	9,125,000	1,127,272							46,752,272	110,627,274
Ore - Cu%	0.614	0.647	0.636	0.608	0.631	0.724							0.630	0.668
Ore - Au g/t	0.197	0.200	0.196	0.184	0.187	0.203							0.193	0.216
<b>Total INPIT</b>	<b>15,034,983</b>	<b>15,001,733</b>	<b>15,023,079</b>	<b>12,936,634</b>	<b>11,753,715</b>	<b>1,350,118</b>							<b>71,100,262</b>	<b>201,798,828</b>
<b>Expit</b>														
Dam Construction														
Road Construction														
Sediment Control Construction														
Other Construction														
Year -1 Stockpile Transfer to Yr 1, Q1														2,099,602
<b>Total Expit</b>														<b>2,099,602</b>
<b>TOTAL - INPIT &amp; EXPIT</b>														
Waste - Saprolite	552,803	999,174	175,088										1,727,064	35,803,458
Waste - Sulphide	4,556,202	4,096,813	4,057,600	2,233,444	2,178,355	208,698							17,331,112	45,572,619
Waste - Inferred	800,978	780,746	1,665,392	1,578,189	450,360	14,148							5,289,813	9,795,476
Waste - Total	5,909,983	5,876,733	5,898,080	3,811,633	2,628,715	222,846							24,347,990	91,171,553
Ore	9,125,000	9,125,000	9,125,000	9,125,000	9,125,000	1,127,272							46,752,272	110,627,274
Waste - Expit Construction														
Year -1 Stockpile Transfer to Yr 1, Q1														
<b>TOTAL</b>	<b>15,034,983</b>	<b>15,001,733</b>	<b>15,023,079</b>	<b>12,936,634</b>	<b>11,753,715</b>	<b>1,350,118</b>							<b>71,100,262</b>	<b>201,798,828</b>