CYPRUS ANVIL MINING CORPORATION **INTEROFFICE CORRESPONDENCE**

007124

To John Purkis cc: L.P. Taggart

From J.K. Carrington G. Simpson

Date June 16, 1982

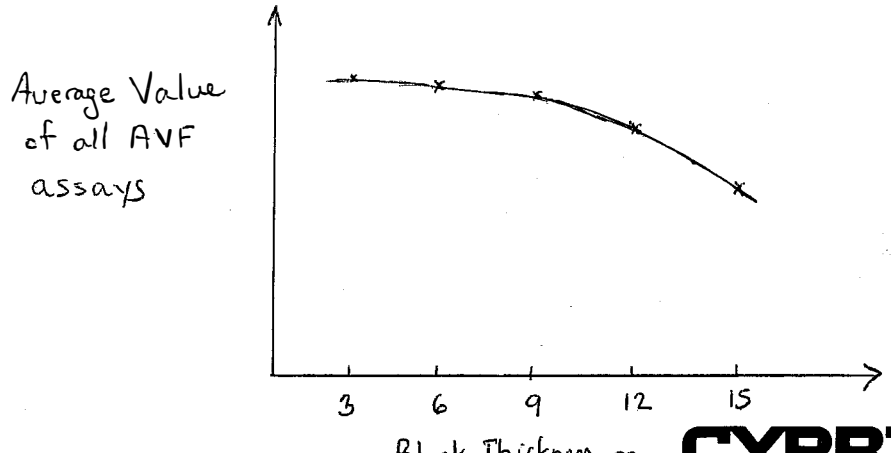
Subject GRUM ORE RESERVE MODELLING

John, attached for your interest are some pages from the Kerr Addison report on the Grum mineral inventory. For anyone studying this deposit I believe this information will be helpful background material. I would suggest you pass it along to any of your people working on the model.

The point to note is that there is a great deal of high grade material in this deposit. This should be borne in mind by any mine planner. One should also understand how the results were generated. The method essentially high graded the orebody, the only constraint being that a given grade interval had to be 3.0 m or greater. An exmaination of the detailed assay sections (KA) will show the results. These are not mineable reserves but are probably a resonable estimate of the in-situ reserves. Pages 16-18 outline this methodology.

The KA computerized Mineral Inventory File (MIF) showed the same overall tonnage but with a significant reduction in the high grade tonnage and a corresponding increase in the lower grade tonnage. This is essentially due to the methodology inherent in a block model reserve calculation. For a given block of a specified size, all the actual drill hole intersections within that block are averaged and this value given to the block. If the block size exceeds the average deposit thickness of the high grade material then its value will be reduced by the value of the lower grade assays given within that block. To verify this effect we did two investigations, on sections 72W and 68W, I believe where we took the manual reserves and superimposed larger and larger block grids onto the manual assay section. For each block size, a section reserve was calculated. The results for 15 m blocks was virtually identical to the computer MIF for 15 m blocks.

To investigate the effect of block thickness, ie. bench height, we composed all the actual value file information (AVF) into 3m, 6m, 9m, 12m and I believe 15m thick blocks. For each thickness, the average of all the actual (real) assay values was computed (I believe they were weighted by length, but I am not sure). The results were as follows:



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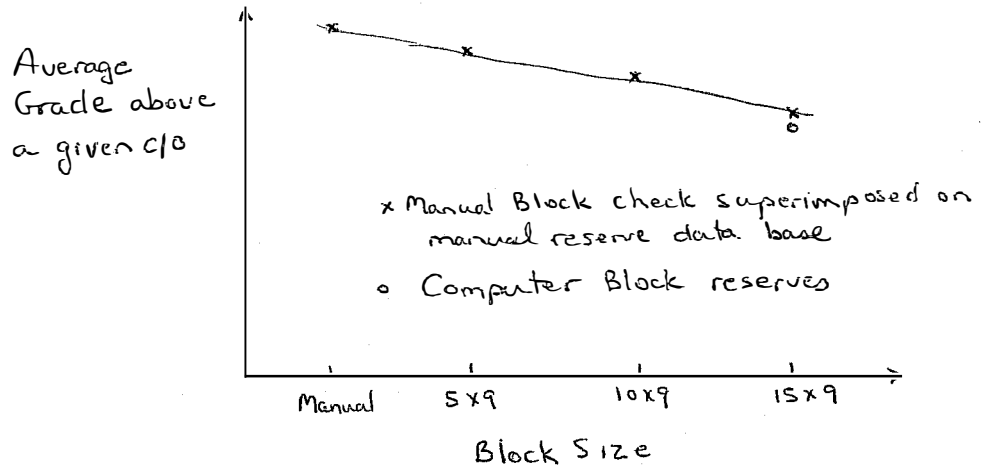
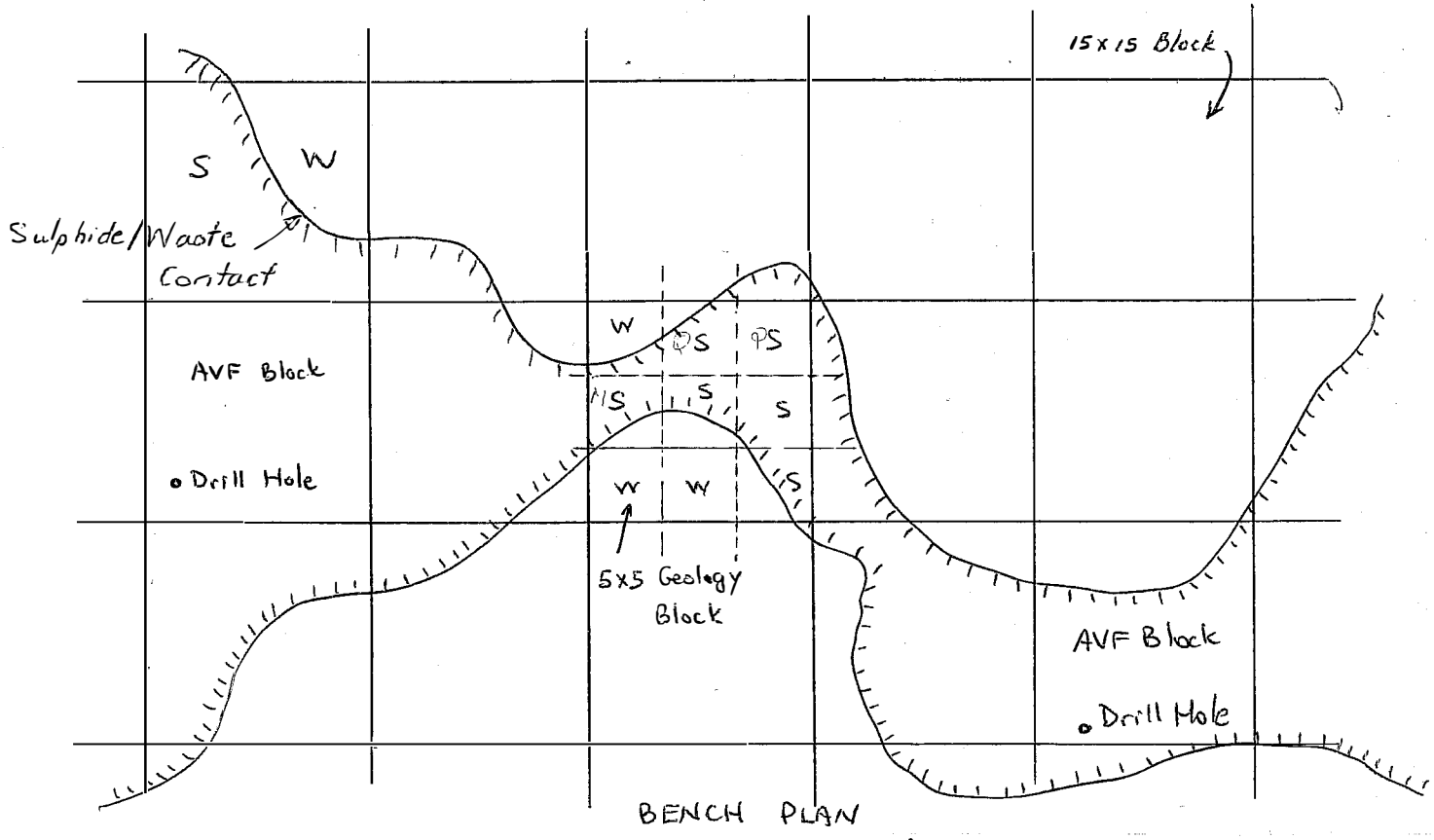
I interpreted this to mean that the average grade of the deposit could be maintained up to 9 - 12m bench heights. Beyond that, the bench height far exceeded the average deposit thickness and introduced significant amounts of zero grade material in the AVF calculations. This was the main reason for selecting a 9m bench height in the KA model. (As well, it was an integral multiple of the minimum thickness, 3.0m, used in the manual calculations.)

The results of the manual check on grade vs. block sizes on sections 68W and 72W were something like:



A note about block size and computer modelling: the complexity of the Grum geology forced us into some non-conventional ways of getting the model and the geology to mesh. In plan 15 X 15 blocks simply washed out the geology detail. But to keep computing costs reasonable, we could not afford to use smaller blocks. After some fiddling around we settled on 5x5x9 for geology and 15 X 15 X 9 for grade interpolation. See the sketch below:



The geology was digitized into 5 X 5 blocks according to rock type. (I have shown Waste and Sulphide, for instance.) Any larger grid just washed out the contact detail. The entire geology was stored in these blocks. For grade interpolation, a 15 X 15 grid was superimposed on this. If any large block contained one or more sulphide 5 X 5 blocks it was included in the MIF routine. Blocks with actual values, ie. drill holes, were known as AVF blocks. These were used to interpolate grades into other mineralized but undrilled blocks. When a grade was determined for a large block, then that grade was assigned to all sulphide 5 X 5 blocks identified in the larger 15 X 15 block. Finally, all the mineralized 5 X 5 blocks were summed and categorized to produce the computerized MIF at various cut off grades.

In summary: Geology identified on 5 X 5 blocks. This was relaxed to 15 X 15 for grade interpolations. Then the grade interpolations were carried back to the 5 X 5 blocks for summation, etc.

Much of this, particularly the grade vs. thickness, material, etc. was graphed and recorded in my working notes which we should have somewhere. Despite changes since KA days I believe that the general conclusions are still valid. I would suggest that the material be found and reviewed. Likewise you should get a copy of the KA MIF ore reserves as they may be useful for comparison purposes as we develop our own model. (This material may be at Grum (Darryl Hanson was familiar with it) - or in Vancouver.)

J.K. Carrington
Manager of Operations

/ljm

all drill hole assay data had been compiled. The final product was a mineral reserve cross section showing in colour the combined lead-zinc values in the sequence 12%+, 10 - 12%, 8 - 10%, 6 - 8%, 4 - 6%, 2 - 4% and 0 - 2%. Along the peripheries of the mineralized zones are shown the length and the average thickness of each zone containing greater than 4% lead-zinc, together with the average lead, zinc and silver assays.

VII. Classification of Mineral Reserves

Despite the density of surface and underground drilling, we are reluctant to use expressions such as the somewhat archaic "proven" classification.

We think the term "drill proven" best describes that portion of the Grum deposit which occurs between sections 62W and 84W. Within this interval no mineralization was projected more than 30 meters from drill hole to drill hole and most of the mineralization is much more closely controlled by the ring drilling patterns.

The core of the deposit (62W - 84W) has been drilled in great detail from underground, even numbered, 60 meter sections with some intermediate drilling on odd numbered sections 69W, 71W, 73W, 75W and 83W. In addition, at the south east end of the deposit, the portion

from 62W to 70W has been drilled on 30 meter centres from the surface and the remainder of the surface drilling has been on 60 meter centres.

Where lead-zinc intersections occur in a drill hole and there are no intersections in adjacent holes or where adjacent holes have not been drilled to that depth, the mineralization has been projected 15 meters on either side of the drill hole.

The term "drill indicated" means that mineralization has been drilled on a 60 meter grid from surface but was not confirmed by underground drilling. This applies only to section 86W.

VIII. Tonnage and Grade Calculations

(a) Specific Gravity Determinations

Having decided that the Grum mineralization could be classified into two principle types for mineral reserve purposes, it became necessary to determine average specific gravities for these two types.

Since the classification "massive sulphides" was based on an actual content of greater than 50% sulphides, there was no problem in selecting representative drill core for specific gravity

determination. However, the term "quartz sulphides" was essentially a textural term wherein the sulphide content could vary from 5 - 50% and consequently specific gravities could be highly variable.

Sixty representative samples were selected from drill core by Jim Paxton and Alexander Po and later an additional 14 were selected from specimens collected by Dave Carson. These samples were analysed for their lead, zinc and iron content and from these results, total sulphide content was calculated on the assumption that all of the content lead, zinc and iron were in sulphide form. From these determinations it was found that the massive sulphides had an average density of 4.10 but when samples containing barite were excluded, the figure dropped to 4.07.

Quartz sulphides were found to have an average specific gravity of 3.18 but this reduced to 3.06 when anomalous pyrite rich samples were excluded.

For ease of calculation and to provide a small factor of safety, a specific gravity of 4.0 was used for calculating massive sulphide tonnages and a specific gravity of 3.0 was used for quartz sulphides.

(b) Methods Used in the Determination of Mineral Reserves

That portion of the Grum deposit which falls between 62W and 84W has been extensively tested by ring drilling on 60 meter centres from

underground, as well as by vertical drill holes on 30 - 60 meter centres from surface. Such being the case, the vertical cross sections provide the best basis for computing mineral reserves. In addition to the detailed ring drilling of even numbered sections 62 - 84W, intermediate ring drilling of lesser density has been done on odd numbered sections 69W, 71W, 73W, 75W and 83W to establish continuity along the long axes of the mineralized structures.

The detailed calculation procedure was as follows:-

(1) Starting with an assay cross section on which all drill holes are shown in their surveyed positions and on which the values are shown as percent combined lead-zinc, the outline of the massive and quartz sulphide types of mineralization shown on the geologic cross sections were traced on to the assay cross section.

(2) Since it had been agreed that the assay sheets would show the outlines of categories 12% +, 10 - 12%, 8 - 10%, 6 - 8%, 4 - 6%, 2 - 4%, 0 - 2%, the procedure then was:

(3) Starting with the highest grade possible over a minimum (mining) width of 10 feet (or three meters), adjoining

samples in the drill hole intersections were composited to give a weighted average which falls within the above mentioned categories over a maximum combined thickness. This procedure was repeated for all categories. Whenever a minimum true width of 3 meters could not be achieved by combining given sample intersections, then the necessary width was gained by adding the required amount from the highest grade adjoining sample (see 44.6 - 47.6m on sketch). The prime purpose was to obtain the highest grade over a maximum length.

The weighted average grades plotted on the assay and mineral reserve sections also show internal intervals of higher and lower categories. Assay wall values were shown to the nearest 1% Pb + Zn.

Drill hole sections show Pb, Zn and Ag assays separately. Mineral reserve sections show the combined Pb + Zn values on the drill hole, but separate Pb, Zn and Ag grades on "ore" blocks.

The mineralized zones were outlined by joining the sulphide zone based on structural control, geological rock boundaries, and mineral composition. The mineral reserves were then calculated, segment by segment from adjoining D.D. hole weighted averages within the zone. Mean thickness of each segment was

arrived at by averaging the measured widths along the segment. The dip length was measured parallel to the boundaries of the segment.

No adjustment has been made for the fact that the cross sections used in computing mineral reserves are not necessarily true cross sections. This discrepancy should be adequately compensated by the use of horizontal distances between sections instead of plunge distances between sections. In ignoring the fact that some additional tonnage results from undulations, both in plan and in longitudinal section, a small factor of safety is built in.

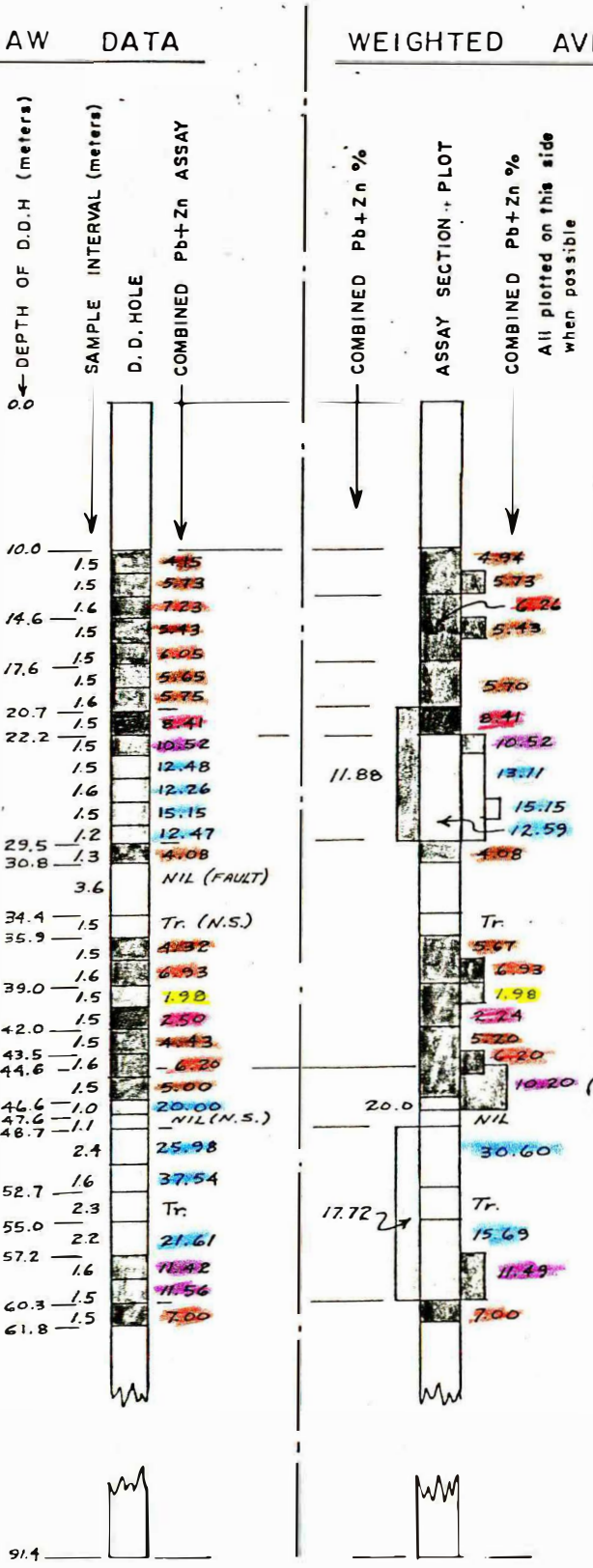
The detailed mineral reserve for each cross section is calculated as follows:-

The drill hole mineralized segments, together with their dip length, thickness and grade are shown on a calculation sheet and from these figures a tonnes x grade calculation is made for each metal. The next step is to total the various grade categories separately and cumulatively, starting from + 12% and reducing in two percent stages down to + 4% combined lead-zinc.

The final step is to combine each grade category from each cross section and to calculate the weighted average for each category. The net result is a calculation sheet showing the tonnage and grade for each category, i.e. + 12%, 10 - 12%, + 10%, 8 - 10%, + 8%, 6 - 8%, + 6%, 4 - 6%, + 4%.

GRUM JOINT VENTURE, Y. T.

Sketch Showing Method Of Portraying Metal Grades On D.D. Hole Sections



* 1. D.D.H. (Assay) Sections show Pb, Zn, Ag assays

* 2. Mineral Reserve Sections show combined Pb+Zn grade on D.D. Holes but separate Pb, Zn, Ag values on mineral reserve blocks

ASSAY COLOR CODE

No Assay	white
0.00 - 1.99	lt. yellow
2.00 - 3.99	
4.00 - 5.99	
6.00 - 7.99	
8.00 - 9.99	
10.00 - 11.99	
12.00 +	blue

(Combining 0.5m of 6.2% to give 3.0m)

(c) Metal Ratios and Variation in Grade

With the exception of the hanging wall zone labelled "H" on the assay cross sections, the Pb:Zn ratio in the Grum deposit is 0.625:1 or for every lb. of lead, there are 1.6 lbs. of zinc. In the "H" zone, the Pb:Zn ratio is 1:1 or better.

Higher grades (10% combined Pb-Zn) persist from 62W to 82W, at which point the fold structure begins to open north westward with an attendant diminution of grade.

Generally speaking there has been a thickening of mineralization in the hinges of folds but this thickening is not necessarily accompanied by an increase in grade or a change in metal ratios. As a rule of thumb, silver content varies with lead content but not as a straight line function. Again, as a generalization, a grade of 5% Pb accompanied by 8% Zn, would have a silver content of 2.5 ozs. (86 gms per metric tonne).

IX. Mineral Reserves

(a) Summary of Reserves - Grum Joint Venture

Drill proven - 62W - 84W

Category	Metric Tonnes	% Lead	% Zinc	Ag (gms/m.t.)
+ 12%	8,651,632	5.95	9.94	88.71
10 - 12%	3,204,722	4.27	6.57	67.76
+ 10%	11,856,354	5.49	9.02	83.02
8 - 10%	2,117,876	3.58	5.29	52.93
+ 8%	13,974,230	5.20	8.46	79.04
6 - 8%	4,378,988	2.70	4.23	41.45
+ 6%	18,353,218	5.01	8.10	76.00
4 - 6%	4,748,944	2.02	2.92	31.16
+ 4%	23,102,162	3.88	6.49	61.62

Drill indicated - 86W only

Category	Metric Tonnes	% Lead	% Zinc	Ag (gms/m.t.)
+ 12%	424,162	5.46	9.25	85.0
10 - 12%	212,840	4.42	6.63	66.0
+ 10%	637,002	5.11	8.37	79.0
8 - 10%	362,198	3.32	5.31	51.0
+ 8%	999,201	4.46	7.26	69.0
6 - 8%	354,308	2.48	4.09	42.0
+ 6%	1,353,508	3.95	6.43	61.0
4 - 6%	325,237	2.14	3.17	33.0
+ 4%	1,678,746	3.59	5.80	55.0

TOTAL DRILL PROVEN AND DRILL INDICATED

24,780,908	3.86	6.42	61.17

Summary of Reserves - Vangorda Mines Option

Drill proven

Category	Metric Tonnes	% Lead	% Zinc	Ag (gms/m.t.)
+ 12%	480,916	7.26	8.22	97.76
10 - 12%	61,357	5.11	6.25	68.97
+ 10%	542,326	7.01	7.99	94.50
8 - 10%	54,803	3.97	4.73	53.45
+ 8%	597,129	6.74	7.69	90.73
6 - 8%	172,154	3.01	3.87	39.87
+ 6%	736,533	5.88	6.78	78.65
4 - 6%	235,355	1.69	3.05	29.42
+ 4%	980,084	5.06	6.03	68.65

TOTAL RESERVES - GRUM JOINT VENTURE AND VANGORDA MINES OPTION

	Metric Tonnes	% Lead	% Zinc	Ag (gms/m.t.)
Grum Joint Venture	24,780,908	3.86	6.42	61.17
Vangorda Option	980,084	5.06	6.03	68.65
Weighted Average	25,760,992	3.91	6.37	61.40

GRUM JOINT VENTURE

REVISED MINERAL INVENTORY - "CHAMP ZONE"

March 21, 1978 (A.Y. Po)

Calculations based on reinterpreted sulphide boundaries. CHAMP zone is bounded by 51W to 63W on cross section and by 13S to 1S on longitudinal section.

Drill Indicated

Category	Metric Tonnes	% Lead	% Zinc	gms/m.t. Silver
+ 12%	140,461	7.16	8.36	79
10 - 12%	342,218	4.71	6.31	63
+ 10%	482,679	5.42	6.91	68
8 - 10%	206,468	3.90	5.14	48
+ 8%	689,147	4.96	6.38	62
6 - 8%	225,979	3.07	3.86	40
+ 6%	915,126	4.49	5.76	57
4 - 6%	777,505	2.34	2.55	33
+ 4%	1,692,631	3.51	4.28	46

Drill Possible

+12%	-	-	-	-
10 - 12%	-	-	-	-
+ 10%	-	-	-	-
8 - 10%	-	-	-	-
+ 8%	-	-	-	-
6 - 8%	37,870	3.28	4.63	34
+ 6%	37,870	3.28	4.63	34
4 - 6%	77,440	1.88	2.60	22
+ 4%	115,310	2.34	3.26	26

(b) Mineral Reserves calculated by Cross Sections - Grum Joint Venture

Sec. No.	Category	Metric Tonnes	% Lead	% Zinc	Ag (gms/m.t.)
62W	+ 12%	138,130	7.28	14.31	107
	10 - 12%	32,773	3.67	6.66	60
	+ 10%	170,903	6.59	12.84	98
	8 - 10%	76,227	3.26	5.55	50
	+ 8%	247,130	5.56	10.59	83
	6 - 8%	62,328	3.36	3.15	47
	+ 6%	309,458	5.12	9.09	76
	4 - 6%	178,186	2.48	2.11	34
	+ 4%	487,644	4.16	6.54	60
64W	+ 12%	347,086	6.00	11.47	100
	10 - 12%	53,286	4.02	7.26	75
	+ 10%	400,372	5.74	10.90	96
	8 - 10%	Nil			
	+ 8%	400,372	5.74	10.90	96
	6 - 8%	140,315	3.01	4.03	41
	+ 6%	540,687	5.03	9.12	82
	4 - 6%	277,960	2.28	2.77	36
	+ 4%	818,647	4.10	6.97	66
66W	+ 12%	387,506	6.06	9.90	87
	10 - 12%	192,327	4.64	6.09	60
	+ 10%	579,833	5.59	8.63	78
	8 - 10%	24,033	3.39	5.17	51
	+ 8%	603,866	5.50	8.50	77
	6 - 8%	118,072	3.02	3.89	40
	+ 6%	721,938	5.09	7.74	71
	4 - 6%	249,381	2.05	3.03	34
	+ 4%	971,319	4.31	6.53	62
68W	+ 12%	579,298	6.95	10.19	100
	10 - 12%	283,768	4.21	6.74	102
	+ 10%	863,066	6.05	9.06	100
	8 - 10%	162,868	4.23	4.80	61
	+ 8%	1,025,934	5.76	8.38	94
	6 - 8%	253,381	3.08	3.78	40
	+ 6%	1,279,315	5.23	7.47	83
	4 - 6%	372,181	2.24	2.80	35
	+ 4%	1,651,496	4.56	6.42	73
70W	+ 12%	1,035,396	6.40	11.01	91
	10 - 12%	254,570	5.06	5.77	64
	+ 10%	1,289,966	6.14	9.98	86
	8 - 10%	283,774	3.96	4.76	53
	+ 8%	1,573,740	5.74	9.04	80
	6 - 8%	352,148	2.67	4.08	40
	+ 6%	1,925,888	5.18	8.13	73
	4 - 6%	300,604	2.11	3.08	30
	+ 4%	2,226,492	4.77	7.45	67

Sec. No.	Category	Metric Tonnes	% Lead	% Zinc	Ag (gms/m.t.)
72W	+ 12%	912,602	5.74	9.05	85
	10 - 12%	372,163	4.18	6.61	67
	+ 10%	1,284,765	5.29	8.34	80
	8 - 10%	66,613	3.81	4.74	51
	+ 8%	1,351,378	5.21	8.17	79
	6 - 8%	527,390	2.62	4.38	42
	+ 6%	1,878,768	4.49	7.10	68
	4 - 6%	344,950	1.98	2.93	32
	+ 4%	2,223,718	4.10	6.46	63
74W	+ 12%	1,233,403	5.71	9.18	91
	10 - 12%	396,761	4.17	6.66	67
	+ 10%	1,630,164	5.33	8.57	85
	8 - 10%	233,905	3.30	5.45	48
	+ 8%	1,864,069	5.08	8.18	80
	6 - 8%	490,648	2.64	3.89	42
	+ 6%	2,354,717	4.57	7.29	72
	4 - 6%	423,732	1.83	3.00	30
	+ 4%	2,778,449	4.15	6.63	66
76W	+ 12%	879,817	6.40	10.11	98.24
	10 - 12%	457,748	4.38	6.78	66.94
	+ 10%	1,337,565	5.71	8.97	87.52
	8 - 10%	198,729	3.56	5.19	46.5
	+ 8%	1,536,294	5.44	8.48	82
	6 - 8%	449,931	2.83	4.08	43.43
	+ 6%	1,986,225	4.85	7.49	73
	4 - 6%	746,585	2.05	2.93	30
	+ 4%	2,732,810	4.08	6.24	61
78W	+ 12%	972,994	5.65	10.17	63
	10 - 12%	471,780	4.13	6.58	60
	+ 10%	1,444,774	5.16	8.99	62
	8 - 10%	291,475	3.56	5.28	56
	+ 8%	1,736,250	4.89	8.37	61
	6 - 8%	633,094	2.48	4.26	39
	+ 6%	2,369,338	4.24	7.27	55
	4 - 6%	540,153	1.81	2.92	28
	+ 4%	2,918,497	3.79	6.45	50

Sec. No.	Category	Metric Tonnes	% Lead	% Zinc	Ag (gms/m.t.)
80W	+ 12%	953,294	5.55	8.74	84
	10 - 12%	302,406	4.13	6.32	65
	+ 10%	1,255,700	5.21	8.16	79
	8 - 10%	509,177	3.37	5.26	54
	+ 8%	1,749,565	4.69	7.34	72
	6 - 8%	421,255	2.83	4.30	42
	+ 6%	2,170,821	4.33	6.75	66
	4 - 6%	868,553	2.01	3.09	30
	+ 4%	3,039,373	3.67	5.71	56
82W	+ 12%	1,014,615	5.41	10.05	94.38
	10 - 12%	276,686	3.82	6.88	62.61
	+ 10%	1,291,301	5.07	9.37	87.57
	8 - 10%	143,046	4.06	5.56	56.98
	+ 8%	1,434,347	4.97	8.99	84.52
	6 - 8%	455,478	2.58	4.89	42.79
	+ 6%	1,889,826	4.39	8.00	74.46
	4 - 6%	295,621	1.90	2.82	31.12
	+ 4%	2,185,447	4.06	7.30	68.6
84W	+ 12%	197,503	5.89	10.31	95
	10 - 12%	157,733	4.02	7.18	66
	+ 10%	355,236	5.06	8.92	82
	8 - 10%	293,897	3.65	5.71	56
	+ 8%	649,134	4.42	7.47	70
	6 - 8%	474,948	2.54	4.19	39.95
	+ 6%	1,124,082	3.63	6.20	58.03
	4 - 6%	151,038	2.01	2.91	30.50
	+ 4%	1,375,120	3.33	5.60	53
86W	+ 12%	424,162	5.46	9.25	85
	10 - 12%	212,840	4.42	6.63	66
	+ 10%	637,002	5.11	8.37	79
	8 - 10%	362,198	3.32	5.31	51
	+ 8%	999,201	4.46	7.26	69
	6 - 8%	354,308	2.48	4.09	42
	+ 6%	1,353,508	3.95	6.43	61
	4 - 6%	325,237	2.14	3.17	33
	+ 4%	1,678,746	3.59	5.80	55

(c) Vangorda Mines Ltd. - Mineral Reserves Calculated by Sections

Drill proven - Sections 62W - 68W

Sec. No.	Category	Metric Tonnes	% Lead	% Zinc	Ag (gms/m.t.)
62W	+ 12%	Nil			
	10 - 12%	21,302	3.74	6.46	52
	+ 10%	21,302	3.74	6.46	52
	8 - 10%	33,501	4.39	4.64	55
	+ 8%	54,803	4,14	5.35	54
	6 - 8%	49,766	2.81	3.89	28
	+ 6%	104,569	3.51	4.65	42
	4 - 6%	38,053	2.36	2.93	32
	+ 4%	142,622	3.20	4.19	39
64W	+ 12%	173,339	6.57	8.22	92
	10 - 12%	40,055	5.84	6.15	78
	+ 10%	213,494	6.43	7.83	90
	8 - 10%	21,302	3.32	4.87	51
	+ 8%	234,749	6.15	7.57	86
	6 - 8%	47,217	2.96	3.50	42
	+ 6%	281,965	5.61	6.90	79
	4 - 6%	64,149	1.83	3.14	26
	+ 4%	346,115	4.91	6.20	69
66W	+ 12%	274,804	7.80	8.23	101
	10 - 12%	Nil			
	+ 10%	274,804	7.80	8.23	101
	8 - 10%	Nil			
	+ 8%	274,804	7.80	8.23	101
	6 - 8%	25,830	3.32	3.84	42
	+ 6%	300,658	7.42	7.86	96
	4 - 6%	105,843	1.93	3.05	30
	+ 4%	406,502	5.99	6.61	79
68W	+ 12%	32,773	6.41	8.10	95
	10 - 12%	Nil			
	+ 10%	32,773	6.41	8.10	95
	8 - 10%	Nil			
	+ 8%	32.773	6.41	8.10	95
	6 - 8%	49,341	3.08	4.14	49
	+ 6%	60,691	4.41	5.72	67
	4 - 6%	27,310	2.49	2.34	36
	+ 4%	84,845	4.35	5.61	66