MINTEC, INC.

B.C. HYDRO & POWER AUTHORITY

HAT CREEK MINABILITY STUDY

April, 1978

MINTEC, INC.
MINeral TEChnology Specialists

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HAT CREEK PROJECT

B. C. HYDRO AND POWER AUTHORITY

2780 NORTH STONE AVENUE / TUCSON, ARIZONA 85705 / TELEPHONE: 602-623-5610

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MINABILITY STUDY -- HAT CREEK PROJECT
BRITISH COLUMBIA HYDRO & POWER AUTHORITY

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1.0 INTRODUCTION

The purpose of this study is to examine the distribution of waste within the CMJV[1] zones used in the MEPS[2] model of the Hat Creek deposit of B. C. Hydro. This study was made at the request of B. C. Hydro and Power Authority.

The zones within the CMJV and MEPS model assume that the material within each zone will be mined as a unit. This method assumes internal waste within an ore zone is mined with the ore and will therefore dilute the average grade measured in BTU's. If the average grade, including internal dilution, of a zone is above the cutoff, the effect is to increase the tons and decrease the grade overall. If the average grade after dilution is below the cutoff, the overall tonnage is reduced and the grade increased.

Based upon assumptions for the degree of selectivity obtainable in mining, the effect on overall reserves of internal dilution can be measured if each drill hole intersection with a zone is assumed to have an equal area of influence. The coal tonnage is therefore assumed directly proportional to the total length of all coal intersections so the comparison can be based upon total intersection length.

1.0 Introduction (Cont'd)....

The basis for mining selectivity is the grade as measured in BTU's. The mining selectivity is defined by the minimum waste thickness which can be selectively mined within a coal zone and discarded, and the minimum coal thickness which can be mined within waste zones.

(1)

CMJV -- Cominco-Monenco Joint Venture

(2)

MEPS -- A Computerized System used by CMJV

2.0 SUMMARY

The basic purpose of this study was to determine the difference to be expected between using the CMJV zones as minable units or assuming internal waste within the zones can be selectively mined.

Numerous computer runs were made examining various combinations of cutoff grades and mining thickness, however the results can be best described by comparing two runs using the assumptions below and based upon the true thickness and the CMJV good data for drilling in 1976 through 1978.

CMJV - the CMJV work is represented by compositing all intervals within each zone and summarizing the results with a 4000 BTU cutoff.

MIN-ABLE the removal of internal waste is represented by the compositing of zones by removing waste above .5 meters in thickness, and applying a 4000 BTU cutoff and .5 meter minimum thickness to coal.

These runs are compared below.

2.0 Summary (Cont'd)....

	CMJV	MINABLE
Zone A	3065 m 5544 BTU	2703 m 6843 BTU
Zone B	1892 m 7238 BTU	1815 m 7529 BTU
Zone C	1351 m 6291 BTU	1398 m 6551 BTU
Zone D	4546 m 9092 BTU	4532 m 9126 BTU
TOTAL	10854 m 7350 BTU	10448 m 7875 BTU

The obvious results are an improvement in grade within each zone. The effect on the A zone is most significant.

Additional dilution will result at each ore/waste intersection in both cases and is not included in this summary.

3.0 CONCLUSIONS AND RECOMMENDATIONS

The results of this study show that removing internal waste of .5 meters or greater from the CMJV zones will significantly increase the BTU grade of the reserves above a 4000 BTU cutoff grade, especially in the A Zone.

These results are based upon a degree of selectivity which it may not be possible to achieve in mining. However the importance of selectivity in mining is indicated by these results and therefore the reserve calculations and mine planning methods should allow variation in the assumptions regarding selectivity and dilution.

The method of dividing the deposit into zones is adequate to define the geometry, however the procedure of mining each zone as a single unit does not allow the flexibility required for mine planning, especially in the A Zone which will be mined in the early years. Within each zone the coal thickness, quality parameters, and waste thickness should be defined.

4.0 DRILL HOLE DATA

The drill hole data is the basis for all computations, so it must be checked with extreme care. Appendices 1.1 and 1.2 contain the data lists of the collar locations and assay data.

4.1 Drill Hole Data Received

Data for 141 drill holes was received on magnetic tape.

The survey data for each hole included:

- east coordinate of collar
- north coordinate of collar
- elevation coordinate of collar
- average azimuth
- average dip
- depth of overburden
- length of hole

For each sample interval the data included:

- depth from collar to beginning of interval
- depth from collar to end of interval
- zone code
- % moisture
- % ash
- % volatiles
- BTU's
- % sulfur

4.1 Drill Hole Data Received (Cont'd)....

Each interval contained a code indicating whether or not the interval was used in the CMJV study. The data assumed not used by CMJV will be referred to as 'commented' data and the data used as 'good' data.

Down the hole survey data was not received for the holes and while it may not alter the results, it should be used since it most accurately locates the zone intersections.

Additional holes are within and on the fringe of the pit area, however they are not included in the data for various reasons indicated by CMJV.

4.2 Data Entry

The drill hole data was reformatted and loaded into the MEDS data files. Several syntax errors in the commented data were found and corrected.

The information for each sample interval is described in Table 4.1.Items 1--9, 15 and 16 are entered from the data received and the remaining items are computed or entered separately.

In entering the data several minor errors in depths were found and corrected.

4.3 Data Checks

The data was checked for gross errors in analyses by printing separate lists of all intervals with values outside the range specified for each value. These limits were:

	Minimum	Maximum
% moisture	10.	30.
% ash	15.	90.
% volatile	20.	40.
BTU's	0.	12000.
% sulfur	0.	1.
Specific gravity	1.25	2.20

Data outside these limits were examined and corrections made if necessary.

The drill hole collar locations were plotted and compared to a map received. The coordinates for hole 260 were incorrect in the data file and corrected. Numerous holes on the map received were not found in the data received. The majority of these missing holes were on the periphery of the main data with the exception of holes 195 and 234 which are located in the center of the deposit.

4.4 Missing Intervals

Within the data there are two possible ways of handling missing data. If the interval was not sampled because the coal quality was too low to be of interest, a zero can be assumed, but if the missing interval type is unknown, -1 can be used to indicate nothing is known about the interval and no value is assigned for compositing. The former method was used.

4.5 Unused or 'commented' data

Certain data intervals received were preceded by a code of 'c' which apparently indicates the data was not used in the CMJV studies. This code was retained by adding a code to each sample interval (LOC) for which a 0 indicates the data is used and a 1 indicates that it was commented out. This procedure enables the analysis of data to be performed with and without the commented data.

4.6 Geologic Zone Codes

The zones assigned by CMJV are: A11, A12, A13, A14, A21, B11, B12, C11, C21, C22, D11, D12, D13 and D14. Additional codes found were A?, A1?, ?, ???, and W.

4.6 Geologic Zone Codes (Cont'd)....

Additional codes were added to define the overburden and waste rock above the first coal zone. These codes were represented in the data files by numeric codes:

A11 = 111, A12 = 112, A13 = 113, A14 = 114, A21 = 121,

B11 = 211, B12 = 212, C11 = 311, C21 = 321, C22 = 322,

D11 = 411, D12 = 412, D13 = 413, D14 = 414,

overburden = 800,

waste rock above 1st coal = 650,

A? = 900, A1? = 901,

W = 600

4.7 Specific Gravity Calculations

A relationship between specific gravity and ash content was received for a sub zone within each major zone, and was used for the entire zone.

A zone: specific gravity = 1.177 + % ash x .0083

B zone : " " = 1.187 + % ash x .0094

C zone : " " = 1.109 + % ash x .0113

D zone : " " = 1.191 + % ash x .0113

Other : = 1.170 + % ash x .0096

The specific gravity for each interval was computed using the above equations.

4.7 Specific Gravity Calculations (Cont'd)....

Since the specific gravity decreases as the BTU's increase, the application of cutoff grades to the composites without use of the specific gravities would tend to over estimate the BTU's.

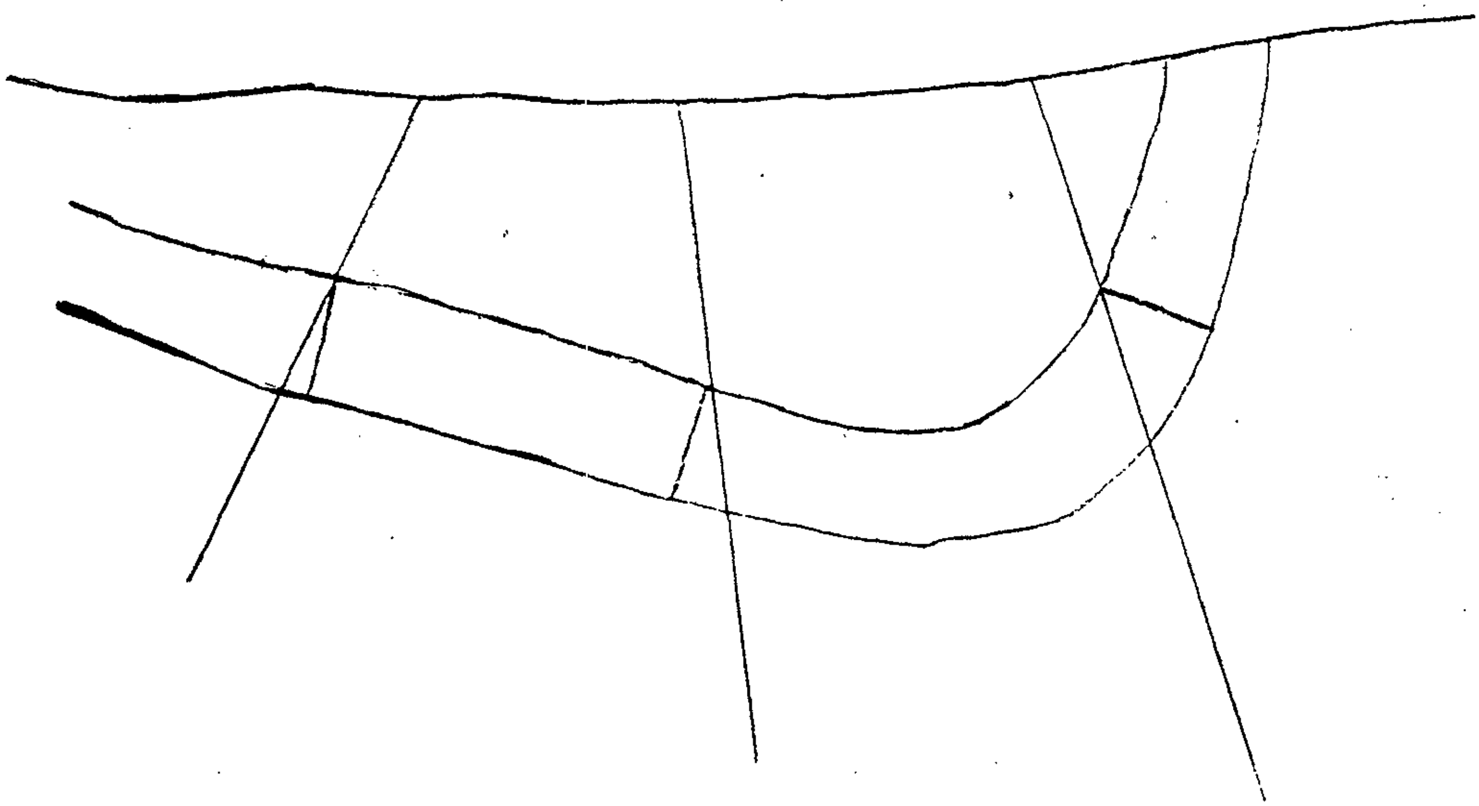
4.8 Zone Intersection Angles

Figure 4.1 illustrates the effect of drill holes intersecting the coal zones at various angles. Drill hole intersections used to measure zone thickness are misleading if the angle of intersection is not perpendicular to the zone.

Although the exact angle of intersection is not possible to measure, the inclination at the top of the zones in the section at each intersection can be estimated from the cross sections provided by B. C. Hydro containing the CMJV zones.

Mr. Simon Handelsman of B. C. Hydro manually measured the seam dips at the top of each zone. From the zone codes on the assay data received, these zone dip angles were directly related to the depths down each hole. Using these dip angles the average dip angle for each sample interval was linearly interpolated.

The sign convention used for the dip angles was to assign a negative sign for a dip to the east and positive sign for a dip to the west.



— TRUE THICKNESS

FIGURE 4.1 -- ILLUSTRATION OF TRUE THICKNESS FOR DRILL HOLE ZONE INTERSECTION

4.9 Calculation of True Thickness

Using the dip angle of each hole projected into the section and the dip angle of each zone, the true thickness of each zone intersection can be computed. The angle between the drill hole and the perpendicular to the zone was computed using the zone dip and the drill hole dip. Using this angle and the intersection length the true thickness was computed.

Item #	Description
1	Drill Hole Number
2	From
3	To
4	Interval length
5	% moisture
6	% ash
7	% volatiles
8	BTU's
9	% sulfur
10	Specific gravity
11	Vertical thickness
12	True thickness
13	Zone dip at intersection
14	Fixed carbon calculated (100% - items (5 + 6 + 7))
15	CMJV zone code
16	Use code 0 = good data, = 1 commented
17	Unused

TABLE 4.1 -- ASSAY RECORD DESCRIPTORS

5.0 STATISTICAL SUMMARIES OF DRILL HOLE DATA

In order to further test the drill hole data, statistical analyses were run on each parameter and the correlation between ash content and BTU's was examined.

5.1 Frequency Distribution

Frequency distributions were examined for BTU's, % moisture, % ash, % sulfur, % volatiles and intersection thickness. Appendix 2 contains these results. These distributions were examined for obvious errors. Table 5.1 is the distribution of BTU's for the assay interval data.

5.2 Correlation between % Ash and BTU's

Since there is correlation between % ash and BTU's, a check on the data can be made by comparing these values in a manner similar to a scatter diagram. Appendix 2 contains this comparison.

TABLE 5.1 - Assay Interval BTU Value Frequency Distribution - Weighted by True Thickness and Specific Gravity

NOTES:

1. This run includes only the good data within the zones in the drilling during 76, 77 and 78.

2. Under the heading TOTAL is the product of true thickness times specific gravity.

3. The BTU value is in hundreds.

4. EFTK is the true thickness

TABLE 5.1

M401V1 STATISTICAL ANALYSIS OF ASSAY DATA

* ASSAY (GOOD, 76/77/78) WEIGHTED BY TRUE THK & S.G. **

B. C. HYDRO AND POWER AUTHORITY HAT CREEK PROJECT

DISTRIBUTION TYPE = 1 NORM

ASSAY INTERVAL	FREQ.	TOTAL	PCT.	GRADE	DEV.	GRADE-CI	GRADE+CI	INT
0.000- 5.000	16.	17919.	100.00	71.522	25.195	71.153	71.891	BTUS
				4.700	2.247	4.667	4.733	EFTK
5.000- 10.000	37.	17903.	99.91	71.582	25.125	71.214	71.950	BTUS
				4.703	2.246	4.670	4.736	EFTK
10.000- 15.000	194.	17867.	99.71	71.714	24.982	71.348	72.081	BTUS
				4.710	2.243	4.677	4.743	EFTK
15.000- 20.000	429.	17672.	98.62	72.355	24.354	71.996	72.714	BTUS
				4.662	1.922	4.634	4.690	EFTK
20.000- 25.000	400.	17243.	96.23	73.715	23.058	73.371	74.059	BTUS
				4.653	1.742	4.627	4.679	EFTK
25.000- 30.000	344.	16843.	93.99	74.930	21.924	74.599	75.261	BTUS
				4.680	1.731	4.654	4.706	EFTK
[illegible]000- 35.000	453.	16499.	92.07	75.924	21.030	75.604	76.245	BTUS
				4.705	1.728	4.679	4.732	EFTK
35.000- 40.000	633.	16046.	89.55	77.151	19.996	76.842	77.460	BTUS
				4.698	1.567	4.673	4.722	EFTK
40.000- 45.000	586.	15413.	86.01	78.780	18.680	78.485	79.074	BTUS
				4.732	1.565	4.707	4.756	EFTK
45.000- 50.000	787.	14828.	82.75	80.209	17.575	79.926	80.492	BTUS
				4.763	1.559	4.738	4.788	EFTK
50.000- 55.000	849.	14040.	78.35	82.044	16.207	81.776	82.312	BTUS
				4.805	1.558	4.779	4.831	EFTK
55.000- 60.000	887.	13191.	73.62	83.945	14.821	83.692	84.198	BTUS
				4.835	1.556	4.809	4.862	EFTK
60.000- 65.000	858.	12305.	68.67	85.846	13.475	85.608	86.084	BTUS
				4.868	1.568	4.840	4.895	EFTK
65.000- 70.000	987.	11447.	63.88	87.599	12.286	87.374	87.824	BTUS
				4.896	1.581	4.867	4.925	EFTK
7[illegible]000- 75.000	1158.	10460.	58.37	89.496	11.105	89.283	89.709	BTUS
				4.948	1.590	4.918	4.979	EFTK
5.000- 80.000	1412.	9302.	51.91	91.632	9.858	91.431	91.832	BTUS
				4.984	1.550	4.953	5.016	EFTK
80.000- 85.000	1431.	7890.	44.03	94.169	8.472	93.982	94.356	BTUS

TABLE 3.1 (continued)

M401V1 STATISTICAL ANALYSIS OF ASSAY DATA

* ASSAY (GOOD, 76/77/78) WEIGHTED BY TRUE THK & S.G. **
C. HYDRO AND POWER AUTHORITY HAT CREEK PROJECT

DISTRIBUTION TYPE = 1 NORM

ASSAY INTERVAL	FREQ.	TOTAL	PCT.	GRADE	DEV.	GRADE-CI	GRADE+CI	INT
				5.033	1.570	4.998	5.068	EFTK
85.000- 90.000	1384.	6459.	36.05	96.726	7.154	96.552	96.901	BTUS
				5.111	1.620	5.071	5.150	EFTK
90.000- 95.000	1523.	5075.	28.32	99.248	5.909	99.085	99.411	BTUS
				5.095	1.288	5.060	5.131	EFTK
95.000-100.000	1350.	3552.	19.82	102.174	4.530	102.025	102.323	BTUS
				5.093	1.269	5.051	5.134	EFTK
100.000-105.000	1143.	2202.	12.29	105.037	3.199	104.903	105.170	BTUS
				5.024	1.133	4.977	5.072	EFTK
105.000-110.000	838.	1059.	5.91	107.709	2.263	107.572	107.845	BTUS
				5.018	1.162	4.948	5.088	EFTK
110.000-115.000	219.	221.	1.23	111.286	1.166	111.131	111.441	BTUS
				4.792	1.304	4.619	4.965	EFTK
[illegible]00-120.000	2.	2.	0.01	117.931	0.000	117.931	117.931	BTUS
				1.578	0.000	1.578	1.578	EFTK
120.000-125.000	0.	-0.	-0.00	0.000	0.000	0.000	0.000	BTUS
				0.000	0.000	0.000	0.000	EFTK

TABLE 5.1 (continued)

```
**M401V1**  STATISTICAL ANALYSIS OF ASSAY DATA

 ** ASSAY (GOOD, 76/77/78)   WEIGHTED BY  TRUE THK & S.G.   **
 B. C. HYDRO AND POWER AUTHORITY          HAT CREEK PROJECT


DISTRIBUTION TYPE =  1  NORM

INT   GRADE     PCT. 0.........+.........5.........+.........10.........+   FREQ
  1   2.500     0.09 0                                                        16.
  2   7.500     0.21 0*                                                       37.
  3  12.500     1.08 0****                                                   194.
  4  17.500     2.39 0**********                                             429.
  5  22.500     2.23 0*********                                              400.
  6  27.500     1.92 0********                                               344.
  7  32.500     2.53 0**********                                             453.
  8  37.500     3.53 0**************                                         633.
  9  42.500     3.27 0*************                                          586.
 10  47.500     4.39 0******************                                     787.
 11  52.500     4.74 0*******************                                    849.
 12  57.500     4.95 0********************                                   887.
 13  62.500     4.79 0*******************                                    858.
 14  67.500     5.51 0**********************                                 987.
 15  72.500     6.46 0**************************                            1158.
 16  77.500     7.88 0********************************                      1412.
 17  82.500     7.99 0********************************                      1431.
 18  87.500     7.73 0*******************************                       1384.
 19  92.500     8.50 0**********************************                    1523.
 20  97.500     7.54 0******************************                        1350.
 21102.500      6.38 0**************************                            1143.
 22107.500      4.68 0*******************                                    838.
 23112.500      1.22 0*****                                                  219.
 24117.500      0.01 0                                                         2.
 25122.500      0.00 0                                                         0.
INT   GRADE     PCT. 0.........+.........5.........+.........10.........+   FREQ
```

6.0 COMPOSITING CMJV ZONES

From the information available, we assume that the method used by CMJV to compute reserves is based upon the minable unit being a complete zone. This means that internal waste is not being discarded regardless of thickness within these zones if the average for the zone is above the BTU cutoff grade.

In order to determine the effect of the inclusion of internal waste, the CMJV zones were composited. Table 6.1 describes the composite results for each zone.

6.1 Calculation Procedures

The calculation procedures used to composite the zones was to weight the interval data within the zones by the true zone length and specific gravity. All good data within the zone is used to compute the weighted average. Appendix 3 contains a list of the composited data. These results are based upon true thickness.

6.2 Summary of CMJV Composites

Table 6.2 summarizes the CMJV composites for a 0.0 BTU cutoff assuming each zone is mined as a unit.

Table 6.3 summarizes the CMJV composites for a 4000 BTU cutoff grade. These results are assumed to represent the CMJV method of compositing and are used as a basis for comparison with the minable composites computed in Section 7.

Table 6.4 is the frequency distribution of the BTU's for the CMJV composites and shows the effect of variation of cutoff grade on the total intersection length and average BTU grade.

6.3 Effect on True Thickness

The effect of using intersection length, vertical thickness, or true thickness was examined and the results are in Tables 6.5 and 6.6. The use of true thickness versus intersection length or vertical thickness does not appear to affect the results.

Item #	Description
1	Drill hole number
2	East coordinate of top of zone
3	North coordinate of top of zone
4	Elevation of top of zone
5	% moisture
6	% ash
7	% volatiles
8	BTU's
9	% sulfur
10	Specific gravity
11	Coal true thickness
12	Waste true thickness
13	Number of ore/waste inter face
14	Dip angle of zone
15	Zone code

TABLE 6.1 -- COMPOSITE ASSAY RECORD DESCRIPTION

TABLE 6.2

C031 * 'GOOD' DATA COMPOSITED BY CMJV ZONES ** 5 APRIL 1978 ** WT= TRUE

MINIMUM GRADE BTU S = 0.00
MINIMUM WASTE THICKNESS = 999.00
MINIMUM COAL THICKNESS = 0.00

ZONE	CMPS	SMPL	METERS	S.G.	MOISTURE	% ASH	% VOL	BTUS	% S	W-THK	'O/W
OVBD	106	90	3542.0	1.94	0.00	80.00	0.00	0	0.00	0.00	0
WST	101	40	1715.8	1.94	0.00	80.00	0.00	0	0.00	0.00	0
FLT	1	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
UKN	3	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
A11	23	183	691.5	1.56	10.44	48.39	13.05	5412	0.49	0.00	0
A12	28	392	1308.9	1.57	7.98	48.68	10.70	5401	0.41	0.00	0
A13	28	176	599.7	1.59	8.01	51.56	11.36	5027	0.35	0.00	0
A14	30	333	1043.2	1.61	8.25	53.45	9.78	4740	0.40	0.00	0
A21	27	139	595.1	1.80	2.67	75.48	2.06	1044	0.10	0.00	0
A-A21	109	1084	3643.3	1.58	8.52	50.49	10.98	5149	0.41	0.00	0
A	136	1223	4238.4	1.61	7.61	54.41	9.58	4505	0.36	0.00	0
B11	39	255	1014.8	1.53	11.47	38.08	14.61	7090	0.55	0.00	0
B12	40	281	1016.9	1.56	10.55	41.51	13.99	6573	0.56	0.00	0
B	79	536	2031.7	1.55	11.01	39.82	14.30	6829	0.56	0.00	0
C11	38	144	803.6	1.90	4.38	71.80	3.52	1692	0.14	0.00	0
C21	38	218	844.4	1.73	7.95	57.64	8.59	3976	0.30	0.00	0
C22	45	274	1192.6	1.71	8.92	55.86	8.74	4222	0.24	0.00	0
C-C11	83	492	2037.0	1.72	8.51	56.60	8.67	4120	0.27	0.00	0
C	121	636	2840.6	1.77	7.26	61.22	7.11	3382	0.23	0.00	0
D11	50	265	1175.2	1.48	12.93	31.71	15.84	8056	0.28	0.00	0
D12	56	244	1125.5	1.41	13.35	24.69	19.40	9130	0.24	0.00	0
D13	61	215	1024.4	1.38	13.88	21.15	19.97	9683	0.30	0.00	0
D14	69	281	1262.9	1.41	13.95	23.79	21.37	9361	0.36	0.00	0
D	236	1005	4588.0	1.42	13.52	25.54	19.11	9027	0.30	0.00	0
ALL	572	3400	13698.7	1.57	9.81	45.12	12.58	5952	0.34	0.00	0
A/A?	1	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
A1?	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
A-A21	110	1084	3643.3	1.58	8.52	50.49	10.98	5149	0.41	0.00	0
ALL A	137	1223	4238.4	1.61	7.61	54.41	9.58	4505	0.36	0.00	0
ORE	508	3117	12300.0	1.54	10.65	41.25	13.91	6574	0.37	0.00	0
ALL	573	3400	13698.7	1.57	9.81	45.12	12.58	5952	0.34	0.00	0

TABLE

C030 * 'GOOD' DATA COMPOSITED BY CMJV ZONES ** 5 APRIL 1978 ** WT= TRUE(76/77/78

MINIMUM GRADE BTU S = 4000.00
MINIMUM WASTE THICKNESS = 999.00
MINIMUM COAL THICKNESS = 0.00

ZONE	CMPS	SMPL	METERS	S.G.	MOISTURE	% ASH	% VOL	BTUS	% S	W-THK	O/W
OVBD	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
WST	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
FLT	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
UKN	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
A11	16	168	627.7	1.55	11.58	46.92	14.49	5654	0.49	0.00	0
A12	22	374	1240.7	1.56	8.44	48.10	11.32	5511	0.43	0.00	0
A13	20	136	462.9	1.56	10.36	48.04	14.97	5597	0.39	0.00	0
A14	19	257	733.7	1.57	9.86	49.22	11.75	5474	0.49	0.00	0
A21	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
A-A21	77	935	3065.0	1.56	9.71	48.12	12.62	5544	0.45	0.00	0
A	77	935	3065.0	1.56	9.71	48.12	12.62	5544	0.45	0.00	0
B11	32	235	951.8	1.51	11.32	35.59	14.83	7472	0.58	0.00	0
B12	34	257	940.2	1.54	10.31	38.70	14.39	7005	0.58	0.00	0
B	66	492	1892.0	1.53	10.81	37.15	14.61	7238	0.58	0.00	0
C11	13	48	165.5	1.59	9.85	44.14	9.54	6175	0.43	0.00	0
C21	22	130	484.8	1.59	10.76	43.48	11.63	6220	0.45	0.00	0
C22	30	164	701.0	1.57	11.75	42.24	11.99	6368	0.37	0.00	0
C-C11	52	294	1185.8	1.58	11.34	42.75	11.84	6307	0.40	0.00	0
C	65	342	1351.3	1.58	11.16	42.92	11.56	6291	0.41	0.00	0
D11	47	260	1156.7	1.47	12.95	31.04	15.81	8157	0.28	0.00	0
D12	54	237	1101.9	1.41	13.31	23.76	19.25	9273	0.25	0.00	0
D13	60	215	1024.4	1.38	13.88	21.15	19.97	9683	0.30	0.00	0
D14	66	281	1262.9	1.41	13.95	23.79	21.37	9361	0.36	0.00	0
D	227	993	4545.9	1.42	13.52	25.12	19.08	9092	0.30	0.00	0
ALL	435	2762	10854.1	1.50	11.61	36.36	15.40	7350	0.41	0.00	0
A/A?	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
A1?	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
A-A21	77	935	3065.0	1.56	9.71	48.12	12.62	5544	0.45	0.00	0
ALL A	77	935	3065.0	1.56	9.71	48.12	12.62	5544	0.45	0.00	0
ORE	422	2714	10688.6	1.50	11.64	36.24	15.49	7370	0.41	0.00	0
ALL	435	2762	10854.1	1.50	11.61	36.36	15.40	7350	0.41	0.00	0

TABLE 6.4 -- Frequency Distribution of BTU for CMJV Composites weighted by True Thickness and Specific Gravity.

NOTES:

1. This run includes only the good data within the zones in the drilling during 76, 77 and 78.

2. Under the heading TOTAL is the product of true thickness times specific gravity.

3. The BTU value is in thousands

4. -DZ- is the true thickness

[illegible] 6.4

M401V1 STATISTICAL ANALYSIS OF ASSAY DATA

** C M J V COMPOSITES BTUS *** 76/77/78 ** WEIGHTING BY T * SG
B. C. HYDRO AND POWER AUTHORITY HAT CREEK PROJECT

DISTRIBUTION TYPE = 1 NORM

ASSAY INTERVAL	FREQ.	TOTAL	PCT.	GRADE	DEV.	GRADE-CI	GRADE+CI	INT
0.000-- 0.500	892.	20812.	100.00	6.159	2.887	6.119	6.198	BTUS
				33.490	18.927	33.232	33.747	-DZ-
0.500-- 1.000	450.	19921.	95.72	6.424	2.656	6.388	6.461	BTUS
				33.274	19.199	33.007	33.541	-DZ-
1.000-- 1.500	718.	19471.	93.55	6.556	2.540	6.520	6.592	BTUS
				33.240	19.334	32.968	33.511	-DZ-
1.500-- 2.000	441.	18753.	90.11	6.759	2.363	6.725	6.792	BTUS
				33.096	19.153	32.822	33.370	-DZ-
2.000-- 2.500	436.	18312.	87.98	6.881	2.254	6.848	6.914	BTUS
				33.204	19.275	32.925	33.483	-DZ-
2.500-- 3.000	183.	17876.	85.89	6.995	2.158	6.964	7.027	BTUS
				33.426	19.423	33.141	33.710	-DZ-
3.000-- 3.500	718.	17693.	85.01	7.040	2.124	7.009	7.071	BTUS
				33.616	19.431	33.329	33.902	-DZ-
3.500-- 4.000	712.	16975.	81.56	7.199	2.019	7.169	7.229	BTUS
				33.353	19.554	33.058	33.647	-DZ-
4.000-- 4.500	871.	16262.	78.14	7.351	1.925	7.321	7.380	BTUS
				33.227	19.610	32.926	33.528	-DZ-
4.500-- 5.000	873.	15391.	73.95	7.525	1.830	7.496	7.554	BTUS
				33.247	19.990	32.931	33.563	-DZ-
5.000-- 5.500	2029.	14518.	69.76	7.695	1.744	7.666	7.723	BTUS
				32.444	18.929	32.136	32.752	-DZ-
5.500-- 6.000	1610.	12489.	60.01	8.096	1.544	8.068	8.123	BTUS
				30.472	17.052	30.173	30.771	-DZ-
6.000-- 6.500	1079.	10880.	52.27	8.443	1.341	8.417	8.468	BTUS
				28.659	16.410	28.350	28.967	-DZ-
6.500-- 7.000	880.	9801.	47.09	8.689	1.175	8.666	8.712	BTUS
				28.107	16.702	27.776	28.438	-DZ-
7.000-- 7.500	1175.	8921.	42.86	8.881	1.051	8.859	8.903	BTUS
				27.980	16.988	27.628	28.333	-DZ-
7.500-- 8.000	1035.	7746.	37.22	9.130	0.894	9.110	9.150	BTUS
				27.564	17.559	27.172	27.955	-DZ-
8.000-- 8.500	1204.	6711.	32.25	9.341	0.764	9.323	9.360	BTUS

TABLE 6.4 (continued)

M401V1 STATISTICAL ANALYSIS OF ASSAY DATA

** C M J V COMPOSITES BTUS *** 76/77/78 ** WEIGHTING BY T * SG
B. C. HYDRO AND POWER AUTHORITY HAT CREEK PROJECT

DISTRIBUTION TYPE = 1 NORM

ASSAY INTERVAL	FREQ.	TOTAL	PCT.	GRADE	DEV.	GRADE-CI	GRADE+CI	INT
				27.752	18.431	27.311	28.193	-DZ-
8.500-- 9.000	1110.	5418.	26.03	9.601	0.606	9.585	9.617	BTUS
				26.321	18.942	25.816	26.826	-DZ-
9.000-- 9.500	1416.	4308.	20.70	9.813	0.488	9.798	9.828	BTUS
				27.058	20.722	26.439	27.677	-DZ-
9.500--10.000	1379.	2893.	13.90	10.081	0.355	10.068	10.094	BTUS
				27.164	24.131	26.285	28.044	-DZ-
10.000--10.500	1160.	1513.	7.27	10.348	0.259	10.335	10.361	BTUS
				22.472	7.486	22.095	22.850	-DZ-
10.500--11.000	303.	353.	1.70	10.715	0.162	10.698	10.732	BTUS
				22.814	7.719	22.006	23.622	-DZ-
11.000--11.500	50.	50.	0.24	11.049	0.000	11.049	11.049	BTUS
				37.591	0.000	37.591	37.591	-DZ-
11.500--12.000	0.	-0.	-0.00	0.000	0.000	0.000	0.000	BTUS
				0.000	0.000	0.000	0.000	-DZ-
12.000--12.500	0.	-0.	-0.00	0.000	0.000	0.000	0.000	BTUS
				0.000	0.000	0.000	0.000	-DZ-

TABLE 6.4 (continued)

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**M401V1**  STATISTICAL ANALYSIS OF ASSAY DATA

 ** C M J V   COMPOSITES  BTUS     *** 76/77/78 ** WEIGHTING BY  T * SG
B. C. HYDRO AND POWER AUTHORITY          HAT CREEK PROJECT

DISTRIBUTION TYPE =  1  NORM

INT  GRADE    PCT. 0.........+.........5.........+.........10.........+   FREQ  IN
  1  0.250    4.28 0*****************                                         892.
  2  0.750    2.16 0*********                                                 450.
  3  1.250    3.45 0**************                                            718.
  4  1.750    2.12 0********                                                  441.
  5  2.250    2.10 0********                                                  436.
  6  2.750    0.88 0****                                                      183.
  7  3.250    3.45 0**************                                            718.
  8  3.750    3.42 0**************                                            712.
  9  4.250    4.19 0*****************                                         871.
 10  4.750    4.19 0*****************                                         873.
 11  5.250    9.75 0***************************************                  2029.
 12  5.750    7.73 0*******************************                          1610.
 13  6.250    5.18 0*********************                                    1079.
 14  6.750    4.23 0*****************                                         880.
 15  7.250    5.64 0***********************                                  1175.
 16  7.750    4.97 0********************                                     1035.
 17  8.250    6.22 0*************************                                1294.
 18  8.750    5.33 0*********************                                    1110.
 19  9.250    6.80 0***************************                              1416.
 20  9.750    6.63 0***************************                              1379.
 21 10.250    5.57 0**********************                                   1160.
 22 10.750    1.46 0******                                                    303.
 23 11.250    0.24 0*                                                          50.
 24 11.750    0.00 0                                                            0.
 25 12.250    0.00 0                                                            0.
INT  GRADE    PCT. 0.........+.........5.........+.........10.........+   FREQ  IN
```

TABLE 6.5

C003 * 'GOOD' DATA COMPOSITED BY CMJV ZONES ** 6 APRIL 1978 ** WT= LNTH(76/77/78

MINIMUM GRADE BTU S = 4000.00
MINIMUM WASTE THICKNESS = 999.00
MINIMUM COAL THICKNESS = 0.00

ZONE	CMPS	SMPL	METERS	S.G.	MOISTURE	% ASH	% VOL	BTUS	% S	W-THK	O/W
OVBD	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
WST	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
FLT	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
UKN	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
A11	16	168	697.8	1.55	11.85	46.95	14.62	5646	0.48	0.00	0
A12	22	374	1429.9	1.56	8.26	48.27	10.89	5485	0.43	0.00	0
A13	20	136	564.3	1.57	10.75	48.47	15.10	5516	0.39	0.00	0
A14	19	257	926.7	1.57	10.13	49.37	11.50	5438	0.49	0.00	0
A21	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
A-A21	77	935	3618.7	1.56	9.81	48.33	12.42	5508	0.45	0.00	0
A	77	935	3618.7	1.56	9.81	48.33	12.42	5508	0.45	0.00	0
B11	32	235	1111.0	1.52	11.07	35.98	14.45	7414	0.58	0.00	0
B12	34	257	1093.7	1.54	10.39	39.12	14.39	6942	0.59	0.00	0
B	66	492	2204.7	1.53	10.73	37.55	14.42	7178	0.58	0.00	0
C11	13	48	197.7	1.60	9.95	44.77	10.29	6050	0.41	0.00	0
C21	22	130	585.8	1.58	11.38	43.08	12.56	6272	0.44	0.00	0
C22	30	164	803.4	1.57	12.27	42.01	12.94	6397	0.37	0.00	0
C-C11	52	294	1389.2	1.57	11.89	42.46	12.78	6344	0.40	0.00	0
C	65	342	1586.9	1.58	11.65	42.75	12.46	6307	0.40	0.00	0
D11	47	260	1395.6	1.47	12.34	30.85	16.19	8193	0.28	0.00	0
D12	54	237	1279.0	1.41	13.11	23.69	19.56	9285	0.24	0.00	0
D13	60	215	1196.6	1.38	13.86	21.20	20.29	9672	0.30	0.00	0
D14	66	281	1516.5	1.41	14.18	23.64	22.27	9371	0.36	0.00	0
D	227	993	5387.7	1.42	13.36	25.06	19.57	9100	0.30	0.00	0
ALL	435	2762	12798.0	1.50	11.63	36.43	15.62	7337	0.41	0.00	0
A/A?	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
A1?	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
A-A21	77	935	3618.7	1.56	9.81	48.33	12.42	5508	0.45	0.00	0
ALL A	77	935	3618.7	1.56	9.81	48.33	12.42	5508	0.45	0.00	0
ORE	422	2714	12600.3	1.50	11.66	36.29	15.71	7359	0.41	0.00	0
ALL	435	2762	12798.0	1.50	11.63	36.43	15.62	7337	0.41	0.00	0

TABLE 6.6

.004 * 'GOOD' DATA COMPOSITED BY CMJV ZONES ** 6 APRIL 1978 ** WT= VERT(76/77/78

MINIMUM GRADE BTU S = 4000.00
MINIMUM WASTE THICKNESS = 999.00
MINIMUM COAL THICKNESS = 0.00

ZONE	CMPS	SMPL	METERS	S.G.	MOISTURE	% ASH	% VOL	BTUS	% S	W-THK	O/W
OVBD	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
WST	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
FLT	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
UKN	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
A11	16	168	688.8	1.55	12.00	46.90	14.81	5653	0.49	0.00	0
A12	22	374	1398.4	1.56	8.28	48.30	10.89	5480	0.43	0.00	0
A13	20	136	557.5	1.57	10.87	48.45	15.27	5519	0.39	0.00	0
A14	19	257	914.5	1.57	10.26	49.33	11.64	5445	0.49	0.00	0
A21	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
A-A21	77	935	3559.2	1.56	9.91	48.32	12.52	5510	0.45	0.00	0
A	77	935	3559.2	1.56	9.91	48.32	12.52	5510	0.45	0.00	0
B11	32	235	1088.4	1.52	11.29	35.92	14.73	7424	0.59	0.00	0
B12	34	257	1081.2	1.54	10.50	39.13	14.54	6939	0.59	0.00	0
B	66	492	2169.6	1.53	10.90	37.53	14.63	7180	0.59	0.00	0
C11	13	48	194.1	1.60	10.13	44.68	10.47	6063	0.42	0.00	0
C21	22	130	564.5	1.58	11.54	43.33	12.99	6242	0.44	0.00	0
C22	30	164	784.8	1.57	12.44	42.17	13.12	6377	0.37	0.00	0
C-C11	52	294	1349.4	1.58	12.06	42.66	13.06	6320	0.40	0.00	0
C	65	342	1543.5	1.58	11.82	42.91	12.73	6287	0.40	0.00	0
D11	47	260	1376.5	1.47	12.46	30.83	16.38	8198	0.28	0.00	0
D12	54	237	1267.1	1.41	13.22	23.70	19.73	9284	0.25	0.00	0
D13	60	215	1186.2	1.38	13.97	21.23	20.45	9668	0.30	0.00	0
D14	66	281	1504.9	1.41	14.28	23.65	22.43	9369	0.37	0.00	0
D	227	993	5334.6	1.42	13.48	25.06	19.74	9100	0.30	0.00	0
ALL	435	2762	12606.9	1.50	11.76	36.41	15.81	7342	0.41	0.00	0
A/A?	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
A1?	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
A-A21	77	935	3559.2	1.56	9.91	48.32	12.52	5510	0.45	0.00	0
ALL A	77	935	3559.2	1.56	9.91	48.32	12.52	5510	0.45	0.00	0
ORE	422	2714	12412.8	1.50	11.79	36.27	15.90	7363	0.41	0.00	0
ALL	435	2762	12606.9	1.50	11.76	36.41	15.81	7342	0.41	0.00	0

7.0 COMPOSITING BASED UPON MINABILITY

The results described in 6.3 must be compared to composites based upon selective mining.

7.1 Calculation Procedures

The basic rules for compositing the data based upon minability requires three parameters.

C = cutoff grade in BTU's

WT = minimum true waste thickness which can be selectively mined within an ore zone

CT = the minimum true coal thickness which can be mined

The calculation procedure used is a simple one, consistent with the parameters above, but may not give the optimum results in all cases. The procedure involves three steps.

-- the continuous intervals of material below the cutoff were examined and removed if their accumulative thickness exceeded WT.

-- the remaining intervals were examined, and any continuous intervals with an average BTU content less than C or thickness less than CT were removed.

7.1 Calculation Procedures (Cont'd)....

-- the remaining intervals were accumulated within each zone and averaged by zone. The weighting used both thickness and specific gravity. These composites were computed by zone for comparison with the results in 6.3 after applying the cutoff and ore thickness constraint.

7.2 Summary of Results

Tables 7.3 to 7.8 contain these results including a list of the data and resulting composites for each hole. Table 7.1 contains a summary for a 4000 BTU cutoff and .5 meter minimum thickness for both coal and waste.

Table 7.2 shows the distribution of BTU value for the minable composites.

Also in Tables 7.3 to 7.8 is a series of runs examining the effect of various combinations of minimum thickness assumptions for mining.

Tables 7.9 and 7.10 show the effect of using vertical thickness and intersection length in the analysis.

7.3 Dilution

The dilution at the interface between coal and waste is ignored in this study for both sets of composites. However for the minable composites, the number of interfaces is determined. For the base case in Table 7.1 the number of interfaces (O/W) is 1034. Assuming coal loss at each interface at .3 meters (about 1 foot), the coal loss is 310 meters or 3%.

The loss for the CMJV composites would be less, since less internal waste is assumed to be selectively mined.

TABLE 7.1

.016 * 'GOOD' DATA COMPOSITED BY CMJV ZONES ** 5 APRIL 1978 ** WT= TRUE(76/77/78

MINIMUM GRADE BTU S = 4000.00
MINIMUM WASTE THICKNESS = 0.50
MINIMUM COAL THICKNESS = 0.50

ZONE	CMPS	SMPL	METERS	S.G.	MOISTURE	% ASH	% VOL	BTUS	% S	W-THK	O/W
OVBD	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
WST	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
FLT	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
UKN	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
A11	17	126	498.3	1.47	13.78	35.46	17.70	7452	0.66	193.20	103
A12	23	270	979.2	1.49	9.25	38.58	13.29	6979	0.49	329.76	188
A13	24	120	438.9	1.52	9.84	41.51	15.07	6620	0.43	151.87	81
A14	27	223	709.2	1.52	9.59	42.21	12.14	6566	0.54	333.96	167
A21	16	34	77.5	1.60	4.68	50.97	4.05	5259	0.43	269.44	53
A-A21	91	739	2625.6	1.50	10.28	39.49	14.09	6893	0.52	1008.80	539
A	107	773	2703.1	1.50	10.11	39.84	13.79	6843	0.52	1278.24	592
B11	34	222	929.3	1.51	11.86	34.57	15.34	7642	0.59	61.30	58
B12	37	232	886.1	1.52	10.96	35.98	15.38	7411	0.60	118.71	95
B	71	454	1815.3	1.51	11.41	35.26	15.36	7529	0.60	180.01	153
C11	17	40	148.3	1.56	10.01	40.24	9.88	6762	0.46	76.83	22
C21	30	133	506.6	1.58	10.84	42.59	12.50	6423	0.48	205.25	71
C22	44	178	742.8	1.56	11.80	41.00	12.47	6598	0.37	413.86	88
C-C11	74	311	1249.4	1.57	11.41	41.65	12.48	6527	0.41	619.11	159
C	91	351	1397.7	1.57	11.26	41.50	12.21	6551	0.42	695.94	181
D11	48	253	1137.9	1.47	13.12	30.30	15.92	8264	0.28	37.38	19
D12	55	238	1107.6	1.41	13.39	23.82	19.40	9266	0.25	17.89	12
D13	60	214	1023.2	1.38	13.90	21.08	20.00	9693	0.30	1.18	6
D14	66	281	1262.9	1.41	13.95	23.79	21.37	9361	0.36	0.00	71
D	229	986	4531.6	1.42	13.59	24.89	19.18	9126	0.30	56.44	108
ALL	498	2564	10447.7	1.48	11.95	33.04	16.09	7875	0.43	2210.64	1034
A/A?	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
A1?	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
A-A21	91	739	2625.6	1.50	10.28	39.49	14.09	6893	0.52	1008.80	539
ALL A	107	773	2703.1	1.50	10.11	39.84	13.79	6843	0.52	1278.24	592
ORE	465	2490	10221.9	1.47	12.04	32.78	16.28	7913	0.43	1864.37	959
ALL	498	2564	10447.7	1.48	11.95	33.04	16.09	7875	0.43	2210.64	1034

TABLE 7.2 -- Frequency Distribution of BTU's for Minable Composites weighted by True Thickness and Specific Gravity

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NOTES:

1. This run includes only the good data within the zones in the drilling during 76, 77 and 78.

2. Under the heading TOTAL is the product of true thickness times specific gravity.

3. The BTU value is in thousands

4. -DZ- is the true thickness

5. A cutoff of 4000 BTU and minimum thickness of .5 meters was used to compute the compositing.

TABLE 7.2

M401V1 STATISTICAL ANALYSIS OF ASSAY DATA

** MINABLE COMPOSITES BTUS *** 76/77/78 ** WEIGHTING BY T * SG
B. C. HYDRO AND POWER AUTHORITY HAT CREEK PROJECT

DISTRIBUTION TYPE = 1 NORM

ASSAY INTERVAL	FREQ.	TOTAL	PCT.	GRADE	DEV.	GRADE-CI	GRADE+CI	INT
0.000-- 0.500	0.	15421.	100.00	7.875	1.547	7.850	7.899	BTUS
				27.969	16.111	27.714	28.223	-DZ-
0.500-- 1.000	0.	15421.	100.00	7.875	1.547	7.850	7.899	BTUS
				27.969	16.111	27.714	28.223	-DZ-
1.000-- 1.500	0.	15421.	100.00	7.875	1.547	7.850	7.899	BTUS
				27.969	16.111	27.714	28.223	-DZ-
1.500-- 2.000	0.	15421.	100.00	7.875	1.547	7.850	7.899	BTUS
				27.969	16.111	27.714	28.223	-DZ-
2.000-- 2.500	0.	15421.	100.00	7.875	1.547	7.850	7.899	BTUS
				27.969	16.111	27.714	28.223	-DZ-
2.500-- 3.000	0.	15421.	100.00	7.875	1.547	7.850	7.899	BTUS
				27.969	16.111	27.714	28.223	-DZ-
.000-- 3.500	0.	15421.	100.00	7.875	1.547	7.850	7.899	BTUS
				27.969	16.111	27.714	28.223	-DZ-
3.500-- 4.000	0.	15421.	100.00	7.875	1.547	7.850	7.899	BTUS
				27.969	16.111	27.714	28.223	-DZ-
4.000-- 4.500	89.	15421.	100.00	7.875	1.547	7.850	7.899	BTUS
				27.969	16.111	27.714	28.223	-DZ-
4.500-- 5.000	228.	15333.	99.42	7.896	1.526	7.871	7.920	BTUS
				28.096	16.068	27.842	28.350	-DZ-
5.000-- 5.500	601.	15104.	97.94	7.943	1.488	7.919	7.966	BTUS
				28.337	16.049	28.081	28.593	-DZ-
5.500-- 6.000	1099.	14503.	94.05	8.054	1.411	8.031	8.077	BTUS
				28.726	16.140	28.463	28.989	-DZ-
6.000-- 6.500	1224.	13404.	86.92	8.241	1.301	8.219	8.263	BTUS
				29.123	16.508	28.844	29.403	-DZ-
6.500-- 7.000	1680.	12181.	78.99	8.439	1.197	8.418	8.460	BTUS
				29.289	16.781	28.991	29.587	-DZ-
7.000-- 7.500	1735.	10500.	68.09	8.701	1.078	8.680	8.721	BTUS
				29.042	17.216	28.713	29.372	-DZ-
7.500-- 8.000	1896.	8765.	56.84	8.988	0.943	8.968	9.008	BTUS
				27.982	16.945	27.627	28.337	-DZ-
8.000-- 8.500	1239.	6869.	44.54	9.334	0.758	9.316	9.352	BTUS

TABLE 7.2 (continued)

M401V1 STATISTICAL ANALYSIS OF ASSAY DATA

** MINABLE COMPOSITES BTUS *** 76/77/78 ** WEIGHTING BY T * SG
B. C. HYDRO AND POWER AUTHORITY HAT CREEK PROJECT

DISTRIBUTION TYPE = 1 NORM

ASSAY INTERVAL	FREQ.	TOTAL	PCT.	GRADE	DEV.	GRADE-CI	GRADE+CI	INT
				27.517	18.227	27.086	27.949	-DZ-
8.500-- 9.000	1325.	5631.	36.51	9.572	0.617	9.556	9.588	BTUS
				26.716	18.769	26.226	27.206	-DZ-
9.000-- 9.500	1361.	4305.	27.92	9.819	0.483	9.805	9.833	BTUS
				27.030	20.716	26.411	27.649	-DZ-
9.500--10.000	1431.	2945.	19.09	10.072	0.358	10.059	10.085	BTUS
				27.344	23.955	26.478	28.209	-DZ-
10.000--10.500	1160.	1513.	9.81	10.348	0.259	10.335	10.361	BTUS
				22.472	7.486	22.095	22.850	-DZ-
10.500--11.000	303.	353.	2.29	10.715	0.162	10.698	10.732	BTUS
				22.814	7.719	22.006	23.622	-DZ-
11.000--11.500	50.	50.	0.32	11.049	0.000	11.049	11.049	BTUS
				37.590	0.000	37.590	37.590	-DZ-
11.500--12.000	0.	-0.	-0.00	0.000	0.000	0.000	0.000	BTUS
				0.000	0.000	0.000	0.000	-DZ-
12.000--12.500	0.	-0.	-0.00	0.000	0.000	0.000	0.000	BTUS
				0.000	0.000	0.000	0.000	-DZ-

TABLE 7.2 (continued)

M401V1 STATISTICAL ANALYSIS OF ASSAY DATA

** MINABLE COMPOSITES BTUS *** 76/77/78 ** WEIGHTING BY T * SG
B. C. HYDRO AND POWER AUTHORITY HAT CREEK PROJECT

DISTRIBUTION TYPE = 1 NORM

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INT  GRADE    PCT. 0.........+.........5.........+.........10.........+   FREQ  I
  1  0.250   0.00 0                                                          0.
  2  0.750   0.00 0                                                          0.
  3  1.250   0.00 0                                                          0.
  4  1.750   0.00 0                                                          0.
  5  2.250   0.00 0                                                          0.
  6  2.750   0.00 0                                                          0.
  7  3.250   0.00 0                                                          0.
  8  3.750   0.00 0                                                          0.
  9  4.250   0.58 0**                                                       89.
 10  4.750   1.48 0******                                                  228.
 11  5.250   3.90 0****************                                        601.
 12  5.750   7.13 0*****************************                          1099.
 13  6.250   7.93 0********************************                       1224.
 14  6.750  10.90 0********************************************           1680.
 15  7.250  11.25 0*********************************************          1735.
 16  7.750  12.29 0*************************************************      1896.
 17  8.250   8.03 0********************************                       1239.
 18  8.750   8.60 0**********************************                     1325.
 19  9.250   8.82 0***********************************                    1361.
 20  9.750   9.28 0*************************************                  1431.
 21 10.250   7.52 0******************************                         1160.
 22 10.750   1.97 0********                                                303.
 23 11.250   0.32 0*                                                        50.
 24 11.750   0.00 0                                                          0.
 25 12.250   0.00 0                                                          0.
INT  GRADE    PCT. 0.........+.........5.........+.........10.........+   FREQ  I
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TABLE 7.3

:017 * 'GOOD' DATA COMPOSITED BY CMJV ZONES ** 5 APRIL 1978 ** WT= TRUE(76/77/78

MINIMUM GRADE BTU S = 4000.00
MINIMUM WASTE THICKNESS = 1.00
MINIMUM COAL THICKNESS = 1.00

ZONE	CMPS	SMPL	METERS	S.G.	MOISTURE	% ASH	% VOL	BTUS	% S	W-THK	O/W
OVBD	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
WST	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
FLT	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
UKN	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
A11	17	126	498.3	1.47	13.78	35.46	17.70	7452	0.66	193.20	103
A12	23	276	983.5	1.49	9.23	38.78	13.25	6949	0.48	325.43	175
A13	24	124	441.6	1.52	9.78	41.82	14.96	6575	0.43	149.17	74
A14	27	231	715.7	1.53	9.48	42.71	12.00	6491	0.53	327.47	147
A21	13	34	76.9	1.60	4.47	51.89	3.73	5121	0.42	172.27	42
A-A21	91	757	2639.2	1.50	10.23	39.77	14.01	6852	0.52	995.27	499
A	104	791	2716.0	1.50	10.06	40.13	13.70	6800	0.52	1167.54	541
B11	33	222	929.2	1.51	11.85	34.61	15.34	7635	0.59	60.39	53
B12	37	234	887.9	1.52	10.93	36.13	15.34	7387	0.60	116.90	85
B	70	456	1817.1	1.51	11.40	35.36	15.34	7513	0.60	177.30	138
C11	16	43	149.5	1.56	9.79	40.81	9.62	6677	0.45	45.08	18
C21	30	136	508.7	1.58	10.89	42.70	12.54	6405	0.48	203.20	64
C22	44	183	747.0	1.56	11.73	41.25	12.38	6563	0.37	409.60	78
C-C11	74	319	1255.7	1.57	11.39	41.84	12.45	6499	0.41	612.80	142
C	90	362	1405.2	1.57	11.22	41.73	12.15	6518	0.42	657.88	160
D11	48	254	1138.4	1.47	13.11	30.32	15.92	8262	0.27	36.85	17
D12	55	238	1107.6	1.41	13.39	23.82	19.40	9266	0.25	17.89	12
D13	60	214	1023.2	1.38	13.90	21.08	20.00	9693	0.30	1.18	6
D14	66	281	1262.9	1.41	13.95	23.79	21.37	9361	0.36	0.00	71
D	229	987	4532.1	1.42	13.59	24.90	19.17	9125	0.30	55.91	106
ALL	493	2596	10470.4	1.48	11.93	33.18	16.04	7852	0.43	2058.63	945
A/A?	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
A1?	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
A-A21	91	757	2639.2	1.50	10.23	39.77	14.01	6852	0.52	995.27	499
ALL A	104	791	2716.0	1.50	10.06	40.13	13.70	6800	0.52	1167.54	541
ORE	464	2519	10244.0	1.47	12.02	32.91	16.24	7893	0.43	1841.28	885
ALL	493	2596	10470.4	1.48	11.93	33.18	16.04	7852	0.43	2058.63	945

TABLE 7.*

:018 * 'GOOD' DATA COMPOSITED BY CMJV ZONES ** 5 APRIL 1978 ** WT= TRUE(76/77/78

MINIMUM GRADE BTU S = 4000.00
MINIMUM WASTE THICKNESS = 1.50
MINIMUM COAL THICKNESS = 1.50

ZONE	CMPS	SMPL	METERS	S.G.	MOISTURE	% ASH	% VOL	BTUS	% S	W-THK	O/W
OVBD	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
WST	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
FLT	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
UKN	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
A11	17	131	505.3	1.47	13.68	36.11	17.48	7356	0.65	186.25	91
A12	23	289	1000.8	1.50	9.11	39.68	13.08	6819	0.47	308.09	147
A13	24	131	450.4	1.53	9.55	42.70	14.60	6450	0.42	140.32	57
A14	27	246	733.3	1.53	9.50	43.65	11.81	6358	0.52	309.86	116
A21	12	33	75.4	1.61	4.53	53.01	3.78	4977	0.42	157.79	33
A-A21	91	797	2689.9	1.51	10.13	40.64	13.79	6727	0.51	944.52	411
A	103	830	2765.4	1.51	9.97	41.00	13.50	6676	0.51	1102.31	444
B11	33	224	931.9	1.51	11.81	34.70	15.29	7622	0.59	57.73	47
B12	37	242	897.2	1.52	10.87	36.58	15.23	7320	0.60	107.60	70
B	70	466	1829.0	1.51	11.35	35.63	15.26	7473	0.59	165.33	117
C11	16	44	150.5	1.56	9.71	41.03	9.54	6645	0.44	44.05	16
C21	30	136	508.7	1.58	10.89	42.70	12.54	6405	0.48	203.20	64
C22	43	181	742.7	1.56	11.81	41.16	12.36	6576	0.37	394.65	70
C-C11	73	317	1251.4	1.57	11.43	41.79	12.43	6506	0.41	597.85	134
C	89	361	1401.9	1.57	11.25	41.71	12.12	6521	0.42	641.90	150
D11	48	254	1138.4	1.47	13.11	30.32	15.92	8262	0.27	36.85	17
D12	55	238	1107.6	1.41	13.39	23.82	19.40	9266	0.25	17.89	12
D13	60	214	1023.2	1.38	13.90	21.08	20.00	9693	0.30	1.18	6
D14	66	281	1262.9	1.41	13.95	23.79	21.37	9361	0.36	0.00	71
D	229	987	4532.1	1.42	13.59	24.90	19.17	9125	0.30	55.91	106
ALL	491	2644	10528.4	1.48	11.89	33.50	15.96	7806	0.42	1965.47	817
A/A?	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
A1?	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
A-A21	91	797	2689.9	1.51	10.13	40.64	13.79	6727	0.51	944.52	411
ALL A	103	830	2765.4	1.51	9.97	41.00	13.50	6676	0.51	1102.31	444
ORE	463	2567	10302.4	1.48	11.98	33.23	16.15	7847	0.42	1763.62	768
ALL	491	2644	10528.4	1.48	11.89	33.50	15.96	7806	0.42	1965.47	817

TABLE 7.5

019 * 'GOOD' DATA COMPOSITED BY CMJV ZONES ** 5 APRIL 1978 ** WT= TRUE(76/77/78

MINIMUM GRADE BTU S = 4000.00
MINIMUM WASTE THICKNESS = 2.00
MINIMUM COAL THICKNESS = 2.00

ZONE	CMPS	SMPL	METERS	S.G.	MOISTURE	% ASH	% VOL	BTUS	% S	W-THK	O/W
OVBD	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
WST	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
FLT	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
UKN	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
A11	17	133	508.5	1.47	13.66	36.39	17.42	7313	0.65	183.01	87
A12	23	299	1017.2	1.50	9.00	40.30	12.93	6717	0.47	291.75	130
A13	24	132	452.9	1.53	9.48	43.05	14.50	6392	0.42	137.86	51
A14	27	254	745.8	1.54	9.35	44.32	11.57	6250	0.51	297.38	104
A21	10	31	71.0	1.62	3.23	54.15	2.85	4818	0.40	136.47	27
A-A21	91	818	2724.4	1.51	10.03	41.17	13.63	6641	0.51	910.00	372
A	101	849	2795.5	1.51	9.84	41.52	13.34	6591	0.50	1046.47	399
B11	33	224	931.9	1.51	11.81	34.70	15.29	7622	0.59	57.73	47
B12	36	248	904.2	1.53	10.82	36.92	15.29	7262	0.59	90.60	57
B	69	472	1836.0	1.52	11.32	35.80	15.29	7443	0.59	148.34	104
C11	16	47	154.0	1.57	9.73	41.78	9.38	6529	0.44	40.59	13
C21	30	140	516.2	1.59	10.78	43.22	12.32	6328	0.47	195.68	52
C22	42	182	745.2	1.57	11.84	41.41	12.30	6540	0.37	371.40	60
C-C11	72	322	1261.4	1.57	11.41	42.16	12.31	6453	0.41	567.08	112
C	88	369	1415.4	1.57	11.22	42.11	11.99	6461	0.41	607.67	125
D11	48	254	1138.4	1.47	13.11	30.32	15.92	8262	0.27	36.85	17
D12	55	238	1107.6	1.41	13.39	23.82	19.40	9266	0.25	17.89	12
D13	60	214	1023.2	1.38	13.90	21.08	20.00	9693	0.30	1.18	6
D14	66	281	1262.9	1.41	13.95	23.79	21.37	9361	0.36	0.00	71
D	229	987	4532.1	1.42	13.59	24.90	19.17	9125	0.30	55.91	106
ALL	487	2677	10579.0	1.48	11.84	33.77	15.88	7763	0.42	1858.39	734
A/A?	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
A1?	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
A-A21	91	818	2724.4	1.51	10.03	41.17	13.63	6641	0.51	910.00	372
ALL A	101	849	2795.5	1.51	9.84	41.52	13.34	6591	0.50	1046.47	399
ORE	461	2599	10354.0	1.48	11.93	33.49	16.09	7805	0.42	1681.33	694
ALL	487	2677	10579.0	1.48	11.84	33.77	15.88	7763	0.42	1858.39	734

TABLE 7.6

020 '*' 'GOOD' DATA COMPOSITED BY CMJV ZONES ** 5 APRIL 1978 ** WT= TRUE(76/77/78

MINIMUM GRADE BTU S = 4000.00
MINIMUM WASTE THICKNESS = 2.50
MINIMUM COAL THICKNESS = 2.50

ZONE	CMPS	SMPL	METERS	S.G.	MOISTURE	% ASH	% VOL	BTUS	% S	W-THK	O/W
OVBD	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
WST	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
FLT	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
UKN	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
A11	17	135	512.8	1.48	13.59	36.74	17.25	7257	0.64	178.75	82
A12	23	316	1048.2	1.51	8.95	41.57	12.67	6521	0.47	260.76	103
A13	24	137	464.6	1.53	9.34	44.09	14.33	6224	0.41	126.20	43
A14	27	257	752.9	1.54	9.37	44.64	11.52	6200	0.51	290.31	98
A21	10	31	72.1	1.63	3.16	55.10	2.80	4643	0.40	135.40	23
A-A21	91	845	2778.4	1.52	9.96	41.97	13.46	6515	0.50	856.02	326
A	101	876	2850.5	1.52	9.78	42.33	13.17	6464	0.50	991.42	349
B11	33	228	938.7	1.51	11.75	34.96	15.15	7582	0.59	50.88	42
B12	36	250	908.7	1.53	10.75	37.20	15.19	7215	0.59	86.02	52
B	69	478	1847.5	1.52	11.26	36.07	15.17	7401	0.59	136.90	94
C11	16	48	156.4	1.57	9.55	42.19	9.21	6463	0.43	38.17	10
C21	30	143	522.6	1.59	10.76	43.41	12.26	6292	0.47	189.28	48
C22	42	182	746.0	1.57	11.78	41.50	12.28	6526	0.37	370.59	55
C-C11	72	325	1268.6	1.58	11.36	42.29	12.27	6429	0.41	559.87	103
C	88	373	1425.1	1.58	11.16	42.28	11.94	6432	0.41	598.03	113
D11	48	254	1138.4	1.47	13.11	30.32	15.92	8262	0.27	36.85	15
D12	55	239	1109.9	1.41	13.35	23.95	19.34	9247	0.25	15.57	11
D13	60	214	1023.2	1.38	13.90	21.08	20.00	9693	0.30	1.18	6
D14	66	281	1262.9	1.41	13.95	23.79	21.37	9361	0.36	0.00	71
D	229	988	4534.4	1.42	13.58	24.93	19.16	9121	0.30	53.59	103
ALL	487	2715	10657.4	1.48	11.78	34.14	15.78	7706	0.42	1779.94	659
A/A?	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
A1?	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
A-A21	91	845	2778.4	1.52	9.96	41.97	13.46	6515	0.50	856.02	326
ALL A	101	876	2850.5	1.52	9.78	42.33	13.17	6464	0.50	991.42	349
ORE	461	2636	10428.9	1.48	11.88	33.85	15.99	7749	0.42	1606.38	626
ALL	487	2715	10657.4	1.48	11.78	34.14	15.78	7706	0.42	1779.94	659

TABLE 7.7

021 * 'GOOD' DATA COMPOSITED BY CMJV ZONES ** 5 APRIL 1978 ** WT= TRUE(76/77/78

MINIMUM GRADE BTU S = 4000.00
MINIMUM WASTE THICKNESS = 3.00
MINIMUM COAL THICKNESS = 3.00

ZONE	CMPS	SMPL	METERS	S.G.	MOISTURE	% ASH	% VOL	BTUS	% S	W-THK	O/W
OVBD	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
WST	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
FLT	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
UKN	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
A11	17	140	523.7	1.48	13.24	37.86	16.80	7096	0.63	167.87	74
A12	23	320	1060.8	1.52	8.87	42.24	12.56	6411	0.46	248.16	85
A13	24	143	481.4	1.54	9.26	45.02	14.07	6078	0.40	109.39	34
A14	26	264	769.0	1.55	9.39	45.57	11.50	6048	0.50	270.32	83
A21	9	28	66.9	1.63	3.41	54.87	3.02	4688	0.36	127.03	21
A-A21	90	867	2834.8	1.52	9.87	42.85	13.29	6377	0.49	795.74	276
A	99	895	2901.7	1.53	9.71	43.14	13.04	6335	0.49	922.77	297
B11	33	229	941.3	1.51	11.71	35.05	15.19	7568	0.59	48.33	38
B12	36	251	911.6	1.53	10.71	37.29	15.13	7203	0.59	83.14	50
B	69	480	1852.9	1.52	11.22	36.16	15.16	7387	0.59	131.47	88
C11	15	49	156.2	1.58	9.56	42.42	9.21	6423	0.44	29.74	6
C21	29	144	525.6	1.59	10.88	43.62	12.46	6259	0.48	154.47	42
C22	41	183	747.2	1.57	11.66	41.79	12.29	6484	0.36	355.84	47
C-C11	70	327	1272.8	1.58	11.34	42.55	12.36	6390	0.41	510.31	89
C	85	376	1429.0	1.58	11.14	42.54	12.02	6394	0.41	540.05	95
D11	47	253	1135.6	1.47	13.15	30.30	15.96	8264	0.28	28.13	13
D12	55	239	1109.9	1.41	13.35	23.95	19.34	9247	0.25	15.57	11
D13	60	214	1023.2	1.38	13.90	21.08	20.00	9693	0.30	1.18	6
D14	66	281	1262.9	1.41	13.95	23.79	21.37	9361	0.36	0.00	71
D	228	987	4531.6	1.42	13.59	24.92	19.17	9122	0.30	44.88	101
ALL	481	2738	10715.2	1.49	11.74	34.47	15.74	7654	0.42	1639.16	581
A/A?	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
A1?	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
A-A21	90	867	2834.8	1.52	9.87	42.85	13.29	6377	0.49	795.74	276
ALL A	99	895	2901.7	1.53	9.71	43.14	13.04	6335	0.49	922.77	297
ORE	457	2661	10492.1	1.48	11.84	34.20	15.94	7694	0.42	1482.40	554
ALL	481	2738	10715.2	1.49	11.74	34.47	15.74	7654	0.42	1639.16	581

TABLE 7.8

CO22 * 'GOOD' DATA COMPOSITED BY CMJV ZONES ** 5 APRIL 1978 ** WT= TRUE(76/77/78

MINIMUM GRADE BTU S = 4000.00
MINIMUM WASTE THICKNESS = 5.00
MINIMUM COAL THICKNESS = 5.00

ZONE	CMPS	SMPL	METERS	S.G.	MOISTURE	% ASH	% VOL	BTUS	% S	W-THK	O/W
OVBD	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
WST	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
FLT	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
UKN	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
A11	17	149	553.0	1.50	12.45	40.63	15.69	6670	0.59	138.56	51
A12	23	357	1164.9	1.54	8.41	45.15	11.61	5962	0.44	144.06	34
A13	24	152	512.4	1.56	8.82	47.18	13.28	5727	0.38	78.37	20
A14	26	283	823.3	1.56	9.41	47.60	11.28	5722	0.48	216.02	51
A21	1	1	5.1	1.63	18.77	54.49	25.65	4710	0.62	19.61	2
A-A21	90	941	3053.5	1.54	9.47	45.37	12.52	5982	0.47	577.01	156
A	91	942	3058.6	1.54	9.48	45.38	12.55	5980	0.47	596.62	158
B11	32	231	943.5	1.51	11.68	35.23	15.14	7539	0.59	26.10	31
B12	35	254	922.8	1.53	10.57	37.92	14.88	7112	0.58	46.20	39
B	67	485	1866.3	1.52	11.13	36.57	15.01	7326	0.59	72.31	70
C11	12	43	144.0	1.57	10.27	41.89	10.03	6503	0.48	12.20	1
C21	28	150	544.4	1.60	10.92	44.71	12.26	6094	0.46	103.76	24
C22	36	178	729.4	1.57	11.92	41.85	12.48	6476	0.37	208.86	29
C-C11	64	328	1273.9	1.58	11.49	43.09	12.39	6311	0.41	312.62	53
C	76	371	1417.9	1.58	11.37	42.97	12.15	6330	0.41	324.82	54
D11	47	254	1140.4	1.47	13.18	30.46	16.00	8242	0.28	23.29	11
D12	54	238	1106.9	1.41	13.39	23.93	19.40	9251	0.25	15.57	10
D13	59	212	1019.5	1.38	13.83	21.02	19.94	9702	0.30	1.18	5
D14	66	281	1262.9	1.41	13.95	23.79	21.37	9361	0.36	0.00	71
D	226	985	4529.7	1.42	13.59	24.95	19.18	9117	0.30	40.04	97
ALL	460	2783	10872.5	1.49	11.66	35.42	15.55	7506	0.41	1033.78	379
A/A?	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
A1?	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
A-A21	90	941	3053.5	1.54	9.47	45.37	12.52	5982	0.47	577.01	156
ALL A	91	942	3058.6	1.54	9.48	45.38	12.55	5980	0.47	596.62	158
ORE	447	2739	10723.4	1.49	11.67	35.32	15.62	7522	0.41	1001.97	376
ALL	460	2783	10872.5	1.49	11.66	35.42	15.55	7506	0.41	1033.78	379

TABLE 7.9

C001 * 'GOOD' DATA COMPOSITED BY CMJV ZONES ** 6 APRIL 1978 ** WT= LNTH(76/77/78

MINIMUM GRADE BTU S = 4000.00
MINIMUM WASTE THICKNESS = 0.50
MINIMUM COAL THICKNESS = 0.50

ZONE	CMPS	SMPL	METERS	S.G.	MOISTURE	% ASH	% VOL	BTUS	% S	W-THK	O/W
OVBD	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
WST	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
FLT	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
UKN	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
A11	17	126	559.1	1.47	14.06	35.52	17.77	7444	0.66	219.60	103
A12	23	268	1126.3	1.49	8.98	38.61	12.88	6971	0.48	384.00	192
A13	24	119	526.5	1.52	10.27	41.52	15.52	6596	0.45	184.50	83
A14	27	219	875.8	1.52	10.09	41.90	12.33	6601	0.55	419.50	175
A21	17	36	93.3	1.60	4.89	50.73	4.27	5292	0.43	398.60	57
A-A21	91	732	3087.7	1.50	10.42	39.51	14.04	6884	0.53	1207.60	553
A	108	768	3181.0	1.50	10.25	39.86	13.74	6834	0.52	1606.20	610
B11	34	221	1079.5	1.51	11.73	34.75	14.98	7617	0.59	80.10	60
B12	37	231	1031.3	1.52	11.16	36.26	15.52	7372	0.62	156.10	97
B	71	452	2110.8	1.51	11.45	35.49	15.24	7497	0.60	236.20	157
C11	18	42	174.1	1.55	10.52	39.90	11.16	6801	0.45	112.30	26
C21	30	132	610.6	1.57	11.29	42.07	13.13	6494	0.47	264.90	73
C22	44	178	858.9	1.56	12.14	40.90	13.29	6610	0.37	514.80	88
C-C11	74	310	1469.5	1.57	11.78	41.39	13.23	6561	0.41	779.70	161
C	92	352	1643.6	1.56	11.65	41.23	13.01	6587	0.42	892.00	187
D11	48	253	1372.9	1.46	12.55	30.08	16.40	8304	0.28	47.70	19
D12	55	238	1286.2	1.41	13.22	23.72	19.74	9281	0.25	25.10	12
D13	60	214	1195.3	1.39	13.88	21.14	20.31	9682	0.30	1.30	6
D14	66	281	1516.5	1.41	14.18	23.64	22.27	9371	0.36	0.00	71
D	229	986	5370.9	1.42	13.45	24.82	19.69	9135	0.30	74.10	108
ALL	500	2558	12306.3	1.48	12.00	32.98	16.40	7880	0.43	2808.50	1062
A/A?	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
A1?	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
A-A21	91	732	3087.7	1.50	10.42	39.51	14.04	6884	0.53	1207.60	553
ALL A	108	768	3181.0	1.50	10.25	39.86	13.74	6834	0.52	1606.20	610
ORE	465	2480	12038.9	1.47	12.08	32.73	16.58	7918	0.43	2297.60	979
ALL	500	2558	12306.3	1.48	12.00	32.98	16.40	7880	0.43	2808.50	1062

TABLE 7.10

C002 * 'GOOD' DATA COMPOSITED BY CMJV ZONES ** 6 APRIL 1978 ** WT= VERT(76/77/78

MINIMUM GRADE BTU S = 4000.00
MINIMUM WASTE THICKNESS = 0.50
MINIMUM COAL THICKNESS = 0.50

ZONE	CMPS	SMPL	METERS	S.G.	MOISTURE	% ASH	% VOL	BTUS	% S	W-THK	O/W
OVBD	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
WST	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
FLT	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
UKN	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
A11	17	126	553.2	1.47	14.19	35.54	17.95	7441	0.66	216.44	103
A12	23	268	1101.5	1.49	9.00	38.68	12.89	6960	0.48	373.95	192
A13	24	119	517.1	1.52	10.45	41.47	15.79	6604	0.45	179.83	83
A14	27	219	863.6	1.52	10.22	41.95	12.49	6593	0.55	408.38	175
A21	17	36	89.7	1.60	5.08	50.82	4.44	5280	0.44	391.41	57
A-A21	91	732	3035.3	1.50	10.53	39.54	14.18	6879	0.53	1178.60	553
A	108	768	3125.0	1.50	10.36	39.89	13.88	6830	0.53	1570.01	610
B11	34	221	1058.1	1.51	11.95	34.71	15.27	7623	0.60	76.07	60
B12	37	231	1019.3	1.52	11.28	36.25	15.68	7371	0.62	155.15	97
B	71	452	2077.4	1.51	11.62	35.47	15.47	7499	0.61	231.22	157
C11	17	41	170.8	1.55	10.66	39.85	11.28	6808	0.46	92.05	24
C21	30	132	591.1	1.58	11.42	42.34	13.52	6460	0.47	260.27	73
C22	44	178	838.9	1.56	12.31	41.04	13.49	6589	0.37	500.22	88
C-C11	74	310	1430.0	1.57	11.94	41.58	13.50	6535	0.41	760.48	161
C	91	351	1600.8	1.57	11.81	41.40	13.27	6564	0.42	852.53	185
D11	48	253	1353.8	1.46	12.68	30.06	16.60	8310	0.28	47.60	19
D12	55	238	1274.2	1.41	13.33	23.73	19.91	9280	0.25	25.07	12
D13	60	214	1184.9	1.30	13.99	21.16	20.48	9678	0.30	1.30	6
D14	66	281	1504.9	1.41	14.28	23.65	22.43	9369	0.37	0.00	71
D	229	986	5317.9	1.42	13.57	24.81	19.87	9136	0.30	73.97	108
ALL	499	2557	12121.0	1.48	12.14	32.97	16.60	7882	0.43	2727.73	1060
A/A?	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
A1?	0	0	0.0	0.00	0.00	0.00	0.00	0	0.00	0.00	0
A-A21	91	732	3035.3	1.50	10.53	39.54	14.18	6879	0.53	1178.60	553
ALL A	108	768	3125.0	1.50	10.36	39.89	13.88	6830	0.53	1570.01	610
ORE	465	2480	11860.5	1.47	12.22	32.72	16.78	7919	0.43	2244.27	979
ALL	499	2557	12121.0	1.48	12.14	32.97	16.60	7882	0.43	2727.73	1060

BRITISH COLUMBIA HYDRO AND POWER AUTHORITY

FOR PERSONAL CONTACT

DIAL ____________

TELEX: 04-54456
TWX: 610-922-6438

744 WEST HASTINGS ST., STE. 500
VANCOUVER, B.C. V6C 1A5

File: 604H-1301.4-2

7 April 1978

Mr. A. F. Banfield, Jr.
Mintec, Inc.
2780 North Stone
Tucson, Arizona
U. S. A. 85705

Dear Fred:

Thank you for your notes dated 9 March 1978.

It was decided that it would be reasonable to follow your recommendations of 9 March 1978 which consist of a step by step approach. The initial objectives will be to complete some statistics on minable units and to develop a model initially based on the CMJV 12 coal zones plus two waste zones. By testing the modelling and display capabilities on three or five test sections the value of the model may be established and the capability to model the deposit in the future on other geological interpretations confirmed. To minimize time, the work should initially be done at Mintec's office in Tucson. It has been made clear that all the programs can be set up eventually in Vancouver for use locally. However, due to plotter problems this should be deferred initially.

The following information would be required as input:

(i) A tape of drill hole data containing surveys, sample intervals and zone picks.

(ii) A tape from CMJV of the digitized subzones.

(iii) Geologic cross sections of the zones.

(iv) Plan map of area.

The following would be expected from the study:

1. Statistics on coal and waste by main zones and subzones reflecting minable thicknesses.

...2

2. Initially display three cross sections showing subzones, drill holes, average value at the drill hole for each subzone.

3. Project "characteristics" (coal/waste), % coal, % waste ash, sulphur, Btu (using inverse square or other method).

4. Demonstrate ability to compute pit tonnages for working pits as required.

5. Demonstrate ability to produce bench plans of tons and grade.

It has been the writer's experience that the most successful results are obtained when someone familiar with computer applications, mining and geology works closely with the computer people. Initially this should be full time, subsequently as required. Your plan indicates that most of the above could be met in about two weeks. Shortly after item 2 above is ready it should be reviewed with a BCHPA geologist.

The following notes extracted from your report outline the proposed work in greater detail:

A. The CMJV model being developed divides the deposit into 12 coal zones plus two waste zones vertically. These zones may be as thick as 100' and are described as minable units - analyses are averaged over the entire zone. This process is similar to the compositing of drill hole data into benches, where the effect of compositing on tonnage and grade has been examined for numerous deposits. As the bench height increases, the deposit tonnage above a specified cutoff grade generally decreases. The drilling during the last three years should be used to determine if in fact the zone size is sufficiently small to reflect the distribution of internal waste for reserve calculations and mine planning.

   Based upon the drill hole data and the CMJV zones, the total feet of drilling above the cutoff grade would be computed. The average analyses and relative heat content can also be computed. These results would be compared to those computed for assumptions regarding the selectivity possible in mining defined by minimum coal thickness minable, minimum parting thickness which can be selectively mined within the coal, and cutoff grade.

   This work would require approximately three days after the data has been received by Mintec and entered into their computer system. The calculation procedures are similar to those in use in the evaluation of uranium and oil shale deposits.

   The size of the minable unit in the mine model can be as important as the calculation procedures used. It should be noted that larger units are practical if the distribution of ore and waste within the blocks is defined.

B. The Variable Block Modelling (VBM) method developed by Mintec could be used to model the Hat Creek deposit and has advantage that is easy to display graphically. The required steps to set up the VBM would include:

(i) entry of drill hole data into the Medsystem,
(ii) correlation of major zones and verification,
(iii) selection of minable units using one of several methods (lithology, grade, division of each zone into fixed number of subzones),
(iv) development of gridded seam model (GSM) includes projection of seam or zone geometry and grade. The GSM is composed of a model for each zone or seam in a single file organized by seam. Various section and plan maps can be plotted,
(v) the GSM is converted to a VBM and plotted by the computer for checking by the geologic staff,
(vi) the VBM can be directly updated by the geologist by manual coding or digitizing,
(vii) the VBM initially would be composed of the geologic sections spaced 500' apart. Additional sections would be developed by projection between these sections,
(viii) the method should first be tested on three sections (requiring five sections of data). This test would require at least two weeks after data preparation is complete,
(ix) the data required includes all drill hole data for the five sections with survey data, analyses, and geologic picks for the major zones. Sections containing the geologic interpretation for the middle three sections would be required.

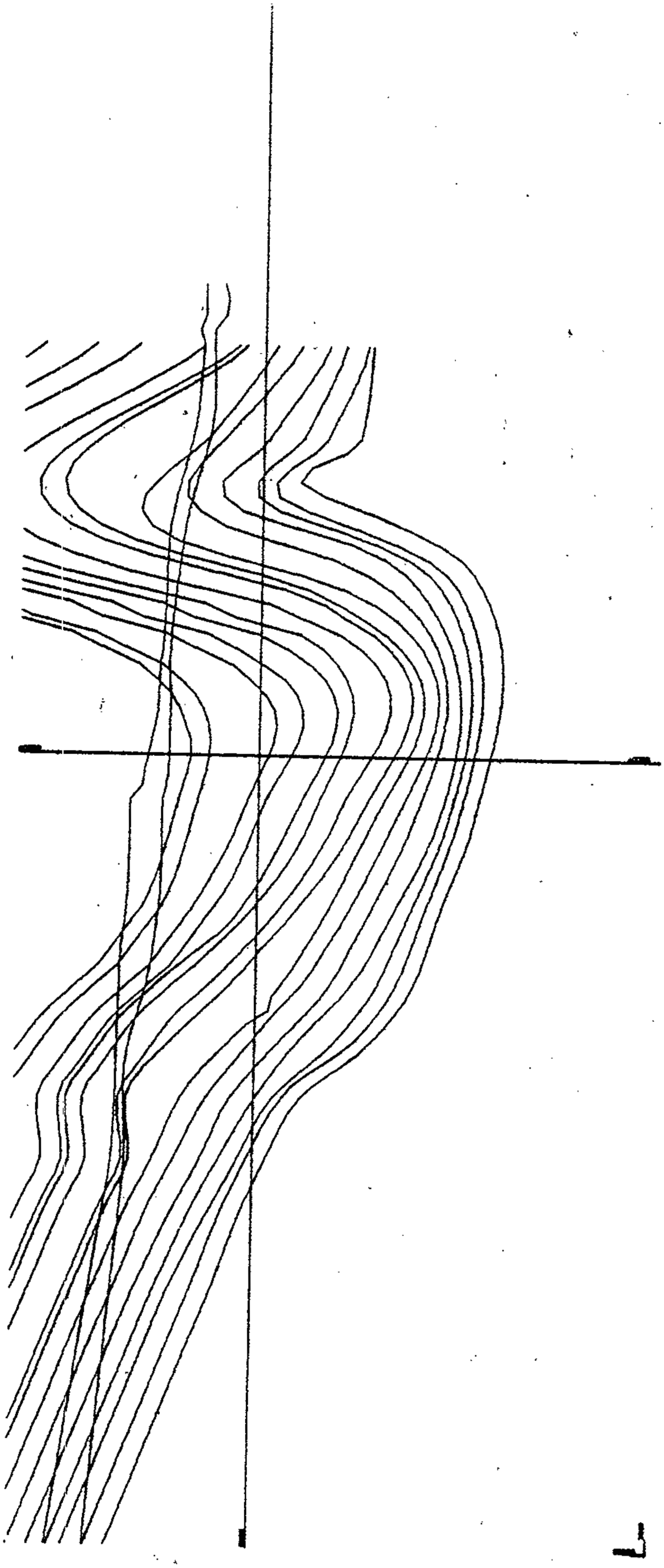
C. The value of the model developed would depend not only on its accuracy, but the ease of using the model to accomplish the required tasks of mine planning. The following capabilities are required:

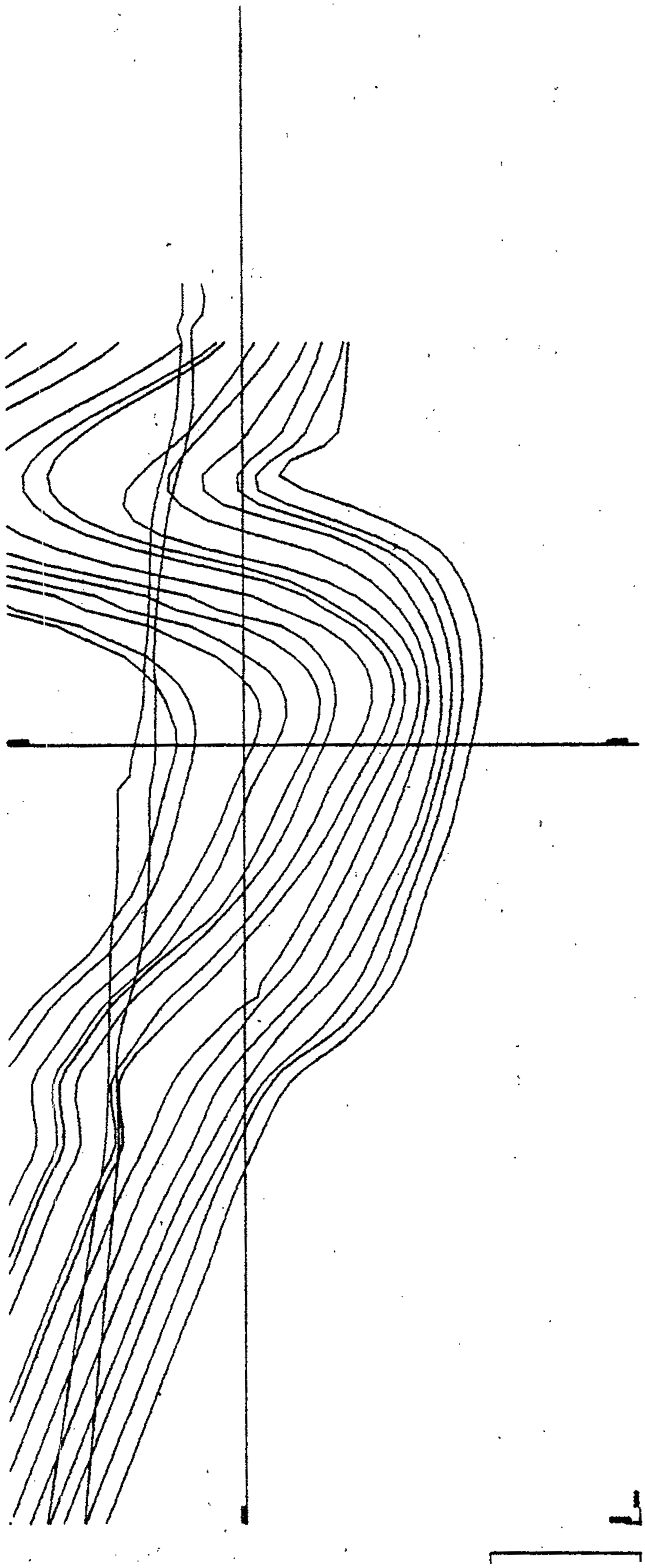
(i) the model must be easy to update,
(ii) the model must be capable of being fully displayed,
(iii) pit designs and sequential mining plans can be evaluated and maps and reserve summaries developed

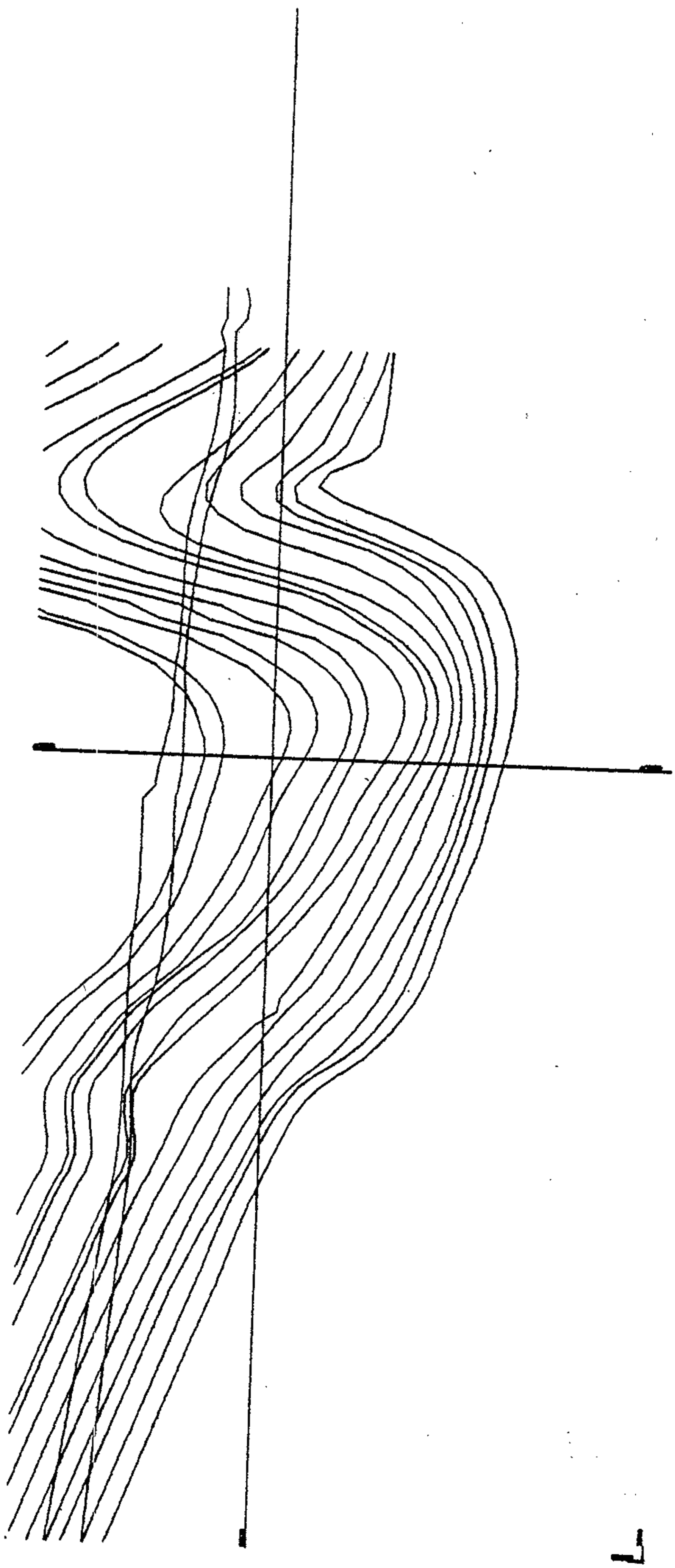
Yours very truly,

S. D. Handelsman, P. Eng.
Staff Mining Engineer
Mining Department

SDH:rak







MINTEC, INC.
MINeral TEChnology Specialists

April, 1978

PRELIMINARY STUDY OF THE FEASIBILITY OF DEVELOPING A VARIABLE BLOCK MODEL FOR THE HAT CREEK PROJECT

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2780 NORTH STONE AVENUE / TUCSON, ARIZONA 85705 / TELEPHONE: 602-623-5610

PRELIMINARY STUDY OF THE FEASIBILITY OF DEVELOPING A VARIABLE BLOCK MODEL FOR THE HAT CREEK PROJECT

1.0 INTRODUCTION

MINTEC has developed a method of modeling coal deposits called the Variable Block Model (VBM). This method allows the development of models which define the geometry of complex deposits accurately for use in mine planning and ore reserve estimations.

The primary advantage of the model is that it represents the geometry of the deposit in a form easily modified by the engineer or geologist and can be displayed graphically.

The Hat Creek Deposit of B.C. Hydro is a complex deposit of 14 zones which are folded and faulted. In order to test the ability of the VBM to model this deposit, three sections are being modeled with the VBM and displayed for verification. Basic data to develop this model is the drill hole data file received from B.C. Hydro.

2.0 SUMMARY

The drill hole data was composited into minable zones based upon the CMJV zone definitions within the drill hole data received from B. C. Hydro. Using this composite data the variable block model was developed for sections R(23950N), Q(24100N), & P(24250N).

This model was developed directly from drill hole data with no manual intervention. Since certain drill holes which would play a role in developing geometry were missing from the file, there are some discrepancies between the VBM and the cross sections received from B. C. Hydro.

Section maps of the VBM were drawn by the computer on a digital plotter. A plan map was developed for several benches showing the coal/zone contacts at the bench medians ? ~~Also~~ Section Q was used to demonstrate the method of determining economic pit limits based upon various stripping ratios. Also reserves were computed from section Q for a pit design.

4.0 VARIABLE BLOCK MODEL DESCRIPTION

The Variable Block Model consists of two files, one for defining the geometry and the other for defining characteristics of the ore. The geometry can be defined in either section or plan and is composed of Features. Each Feature may be either a line or a closed polygon, representing a surface, zone, or pit design. These Features are signed codes which indicate the type of material they define. Ore block Features are further defined by their characteristics stored in the Quality File. Each ore block can be subdivided into smaller blocks depending upon the variability of the grade within the blocks and the density of the data. Figure 2.1 is a sample of a cross section model with the Variable Block Modeling method. Figure 2.2 is a listing of the Quality Data with the blocks.

Sections or benches may be modeled, as required by the geometry of the deposit. The points defining the features can be easily changed in the Variable Block Model Geometry File and the Quality Data can be updated in the Quality File directly. The problems in developing the Variable Block Model for the Hat Creek Project are the definitions of the geometry of the zones and the distribution of grade within the zones.

4.0 <u>Variable Block Model Description</u> (Cont'd)....

Figure 2.3 illustrates a cross section through the deposit with the drill hole data, which is the basis for defining the zone geometry. Normally within the MEDSYSTEM, the geometry is defined by developing a gridded matrix of elevations for the top of each zone in the model. Various methods of gridding the data are available, however, by inspection none appear directly applicable for the Hat Creek Deposit. Also examination of the complex geometry in some of the sections indicated that no matter what method was developed, the geologist will have to be able to manually update the computer results.

5.0 DEVELOPMENT OF THE VARIABLE BLOCK MODEL FROM DIGITIZED DATA

Digitized data files were received from B. C. Hydro defining the surface and the various zones within the deposit. A simple way of developing the VBM directly from these sections was attempted. A vertical plane was passed through the digitized data for each section and the intersections computed. These intersections were sorted and used to develop a Variable Block Model to display the zones within the cross section. This method was based on the assumption that the digitized data points followed the contours of the surfaces. On plotting out a cross section from the Variable Block Model developed by this method, it was found that this assumption was incorrect. Also in manually plotting the digitized data points, it was found that each digitized point was an independent observation and did not necessarily indicate linear continuity with the previous point. For this reason it was not possible to develop a Variable Block Model from the digitized data. However, this method is feasible and is probably the most accurate and representative method available. The computer techniques are simple and inexpensive to perform and depend solely on the accuracy of the digitizing.

5.0 Development of the Variable Block Model from Digitized Data (Cont'd)....

Due to the continuity of the zones each contour line would have to be digitized. Enough contours to adequately define the zone geometry would be required. The quality parameters for the various zones could be interpolated separately and integrated into the model, since an alternative method of developing seam geometry was sought, instead of redigitizing the zones.

6.0 INTERPOLATION OF SEAM GEOMETRY FROM DRILL HOLE DATA

The composite data developed from the minable and the CMJV zones both contained the zone dip for each composite. Based on this information it appeared feasible to develop the geometry of each zone by interpolating between adjacent composites using the assumed seam or zone dip angles. Figure 4.1 describes the process involved. These steps are:

1. The composites for the individual section are selected and stored in a data file.

2. Based on these composites the seam geometry is computed and plotted on the printer.

3. The seam zone geometry is examined and the composite data corrected if necessary.

4. The quality parameters for each zone are interpolated and the zone geometry and quality data are stored in a new data file. The zone geometry and quality data files are read into the Variable Block Model for display and calculations of reserves.

6.0 Interpolation of Seam Geometry from Drill Hole Data (Cont'd)....

5. The Variable Block Model is displayed in plan and in section for verification. Individual points can be updated as required.

7.0 INTERPOLATION OF COAL QUALITY

The coal quality is defined by the BTU's, % ash, % sulfur, coal density, specific gravity, coal thickness and waste thickness. The coal and waste thicknesses are used to determine the percent of the block that is minable as ore. Drill hole spacing within the sections is less than the distance between sections, and for this reason ~~for this first pass through~~ we interpolated the coal characteristics using only the data within the section. It should be kept in mind that the more values that are weighted together to interpolate an individual block, the more the local variations are masked by the averaging. The method used to interpolate the coal characteristics between drill holes within each zone was to interpolate between the adjacent composite values weighting by the inverse of the distance squared, the coal thickness and the specific gravity of the composites. For section Q a detailed listing of these interpolated grades for each grid point in the VBM is displayed. However, since the drill hole spacing is much greater than the spacing of grid points within the VBM, it is unnecessary to retain the individual grades. For this reason the ore zones coal quality values were averaged together for up to ten continuous grid points, or approximately 200 meters. On the fringes of the zones or where there were no adjacent drill holes on each side on the grid point, the nearest composite was projected to the grid point.

8.0 PLAN DISPLAY OF THE VARIABLE BLOCK MODEL

The same method of displaying the variable block model in section can be used to display it in plan. The intersection of the zones with the ~~toll~~ toe crest ~~for~~ or ~~meeting~~ median of a bench can be displayed. The difficulty in using results developed in this manner is that since the angle of intersection ~~with~~ of the zone with the bench not known and the thickness of the coal is not displayed. These coal seams do not indicate the actual tonnage of coal within the bench.

NOTE FOR FRED:

May be possible to actually compute the tonnage within the four points defined by the intersection of the top and the bottom of the seam with the adjacent sections.

In the case where the adjacent composites were not complementary, one being ore and the other being waste, the value of the nearest composite was assigned to the block.