

009563

Hat Creek clays

092I NW 084

Property File

May 9, 1978

Dr. P. T. McCullough
Generation Planning Department
System Engineering Division
B. C. Hydro & Power Authority
555 West Hastings Street
VANCOUVER, B. C.
V6S 4T6

TO FILE:	
Form <input type="checkbox"/>	Perm <input type="checkbox"/>
REPLY:	
COPY	DATE

Dear Terry:

Attached is a copy of the results of the tests performed on the Hat Creek drill core samples by the Alberta Research Council. The corresponding drill hole footages are listed below, along with the results of the preliminary swelling tests carried out by ourselves.

The results are disappointing. The yield values are too low to be of interest.

However this preliminary sampling can not be considered representative of all the relevant core, and we should like to scan all of the sections for which we have logs, using the results obtained so far as a yardstick for further sampling. One or two days should be sufficient to complete the examination and whatever sampling might be necessary. We are presently committed to other work, but I will contact you as soon as possible to make the necessary arrangements, if this is agreeable to Hydro.

Yours truly,

1978

Sample #	Drill Hole #	Footage	Preliminary Swelling Test	
			1 Hour	24 Hours
HC 1	76 - 126	205 - 208	0	3
2	"	208 - 210	2	4
3	"	210 - 212	1	2
4	76 - 130	235 - 238	0	1
5	"	323'	0	1
6	"	338'	3	6
7	"	342'	3	5
8	"	1621.1 - 1621.4	3	4
9	76 - 136	119.5	0	0
10	"	219 - 221	0	0
11	76 - 170	703.8 - 705	8	9
12	"	(703 - 704)* (705 - 706)	0	2

* Composite sample

'Preliminary Swelling Test'

Approximately 2g. air dried material added in small increments to 100 ml. of demineralized water. Amount of 'gel' formed measured after one hour and 24 hours.

Sample	Plastic Viscosity (cp)	Yield Point (lb/100 ft ²)	Apparent Viscosity (cp)	Yield (lb/ft ²)	Gel Strength (lb/100 ft ²)		Weight % ^{> 44 μ} > 325 mesh	Bilt Content (estimate)	% Solids*
					10 sec	10 min			
HC-1	3.0	0	3.0	30	1	1.5	2.4	high	10
HC-2	6.0	1.5	6.75	38	1.5	2.0	0.4	low	10
HC-3	2.5	0	2.25	28	1.0	1.0	3.7	high	10
HC-4	1.5	1.0	2.0	27	1.0	2.5	5.3	high	10
HC-5	1.5	0.5	1.75	34	1.0	1.5	6.2	medium	6
HC-6	3.5	0.5	3.75	31	1.5	3.0	2.3	medium	10
HC-7	3.5	0	3.5	31	1.0	2.5	27.8	high	10
HC-8	3.5	1.0	4.0	32	1.5	1.5	12.8	medium	10
HC-9	1.5	0.5	1.75	34	1.0	2.0	9.0	high	6
HC-10	1.0	1.5	1.75	26	1.0	2.0	4.8	high	10
HC-11	5.0	0.5	5.25	34	1.0	1.5	27.4	high	10
HC-12	2.0	0.5	2.25	28	1.5	4.5	14.0	high	10

*% solids used in determination of yield. 6% recommended but with low yield clays 10% often is needed to obtain accurate values of yield.

MEMO TO: R.M. Dundas
 J.J. Fitzpatrick
 D.K. Whish

DATE: 30 April 1979

FROM: C.B. Guelke

File: 604H-

SUBJECT: Report by B.C. Research on Hat Creek Clay

The study by B.C. Research was undertaken by Dr. John Howard to investigate the use of purified Hat Creek kaolin clay as a filler with particular emphasis on the requirements of the paper industry. The specifications are listed in the accompanying letter to Dr. J. Howard from P.T. McCullough dated 5 May 1978. Initial tests indicated that the treated clay produced by the Department of Metallurgy at U.B.C. was too coarse and the brightness was too low for the paper industry. Therefore the goals of the study were altered to determine if there were methods of improving these characteristics. It was found that the grain size of the raw clay was suitable for the paper industry and that a different method of bleaching and washing the clay was required. Much of the B.C. Research study was devoted to this end. It was found that the standard method of gravity separation of the clay as practiced at the Department of Metallurgy (U.B.C.) worked well. The most effective method of bleaching the clay was found to be a hydrochloric acid treatment to release iron in conjunction with oxygen bleaching in a Parr bomb at 150 psig and 230°C to release carbon. A similar oxygen bleaching technique is being used extensively for industrial and municipal waste treatment.

Oxygen-treated Hat Creek clay is much finer than Georgia clay (96% versus 64% @ - 2 microns); the Hat Creek clay is actually superior in this characteristic; however the brightness of Hat Creek clay is significantly less than Georgia kaolin (46.4% versus 81.0%). The cause of the low brightness is not known. *Electric brightness*

0.5% Fe

During an experiment in trying to bleach the clay with sulphur dioxide it was observed that some of the sulphur dioxide was reduced to elemental sulphur. The reaction that occurred was not determined, but it could have future implications in pollution control processes.

Grain size is an important characteristic of clay required for fillers in plastics, paints and rubber, based on the accompanying information collected by Dr. Howard. The grain size of Hat Creek clay is well within the limits required for such fillers. Tests were not conducted on bulking, oil absorption, refractive index or other properties that may be required to assess the capability of the clay for these uses.

It is proposed that the additional information needed to determine the potential for utilization of Hat Creek kaolin clay should be undertaken in order that a proper evaluation could be made of selective mining procedures. This information includes:

1. the market for Hat Creek kaolin clay as a filler in paper, paint, rubber and plastic,
2. the market for building brick and refractory brick,
3. the market for clay in the cement industry,
4. the cause of the low brightness in Hat Creek treated-clay,
5. the cost of wet oxidation bleaching of clay.
6. the distribution of kaolin clay within the No. 1 deposit.

These studies should await acquisition of a licence and should accompany the initial steps of detailed mine planning.

ORIGINAL SIGNED BY
C. B. GUELKE

PTM/kmt
Attach.

cc: H.J. Goldie



970 Burrard Street · Vancouver B.C. V6Z 1Y3
Telex 04-54512

6 February 1986

File: 604H-

Mr. Z.D. Hora
Industrial Minerals Specialist
Ministry of Energy, Mines and
Petroleum Resources
Parliament Buildings
Victoria, B.C. V8V 1X4

Dear Danny:

Re: Clay from Hat Creek

The inventory sheets on clay from Hat Creek are attached as you requested. The additional information on clay will be sent to you as it is received from storage.

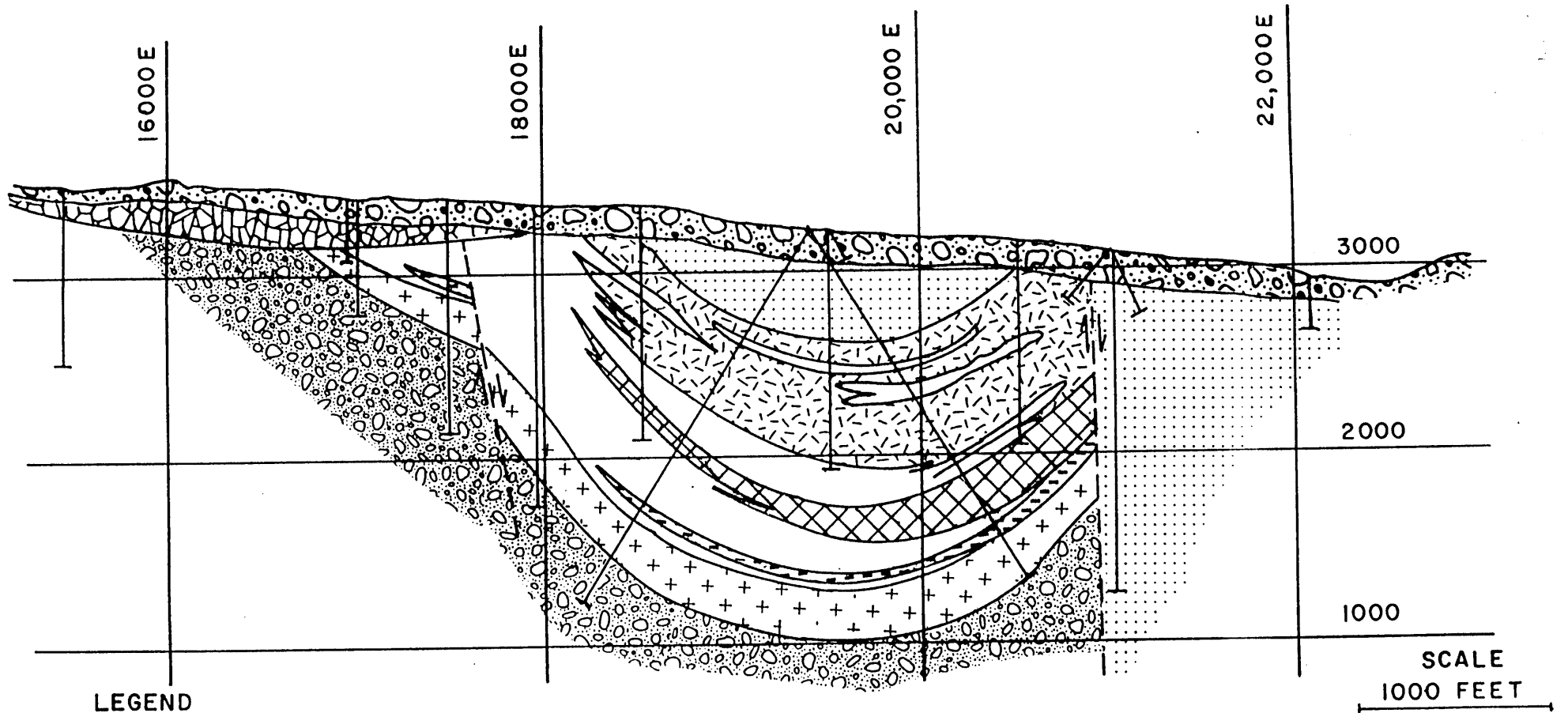
Please let me know if we can be of any further assistance.

Yours truly,










Dr. P.T. McCullough, P.Eng.
Thermal Resources Engineer
Generation Planning Department

Attachment

LOG NO:	02.7	K 3
DATE:		
FILE NO:		



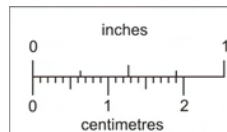
LEGEND

-  OVERBURDEN
 -  SLIDE DEBRIS
 -  HANGING WALL SEDIMENTARY ROCKS
 -  PARTINGS
 -  A-ZONE
 -  B-ZONE
 -  C-ZONE
 -  D-ZONE
 -  FOOT WALL SEDIMENTARY ROCKS
- } COAL ZONES

 FAULT WITH RELATIVE MOVEMENT

 DRILL HOLE

ELEVATIONS AND COORDINATES
IN FEET.




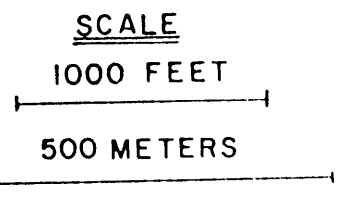
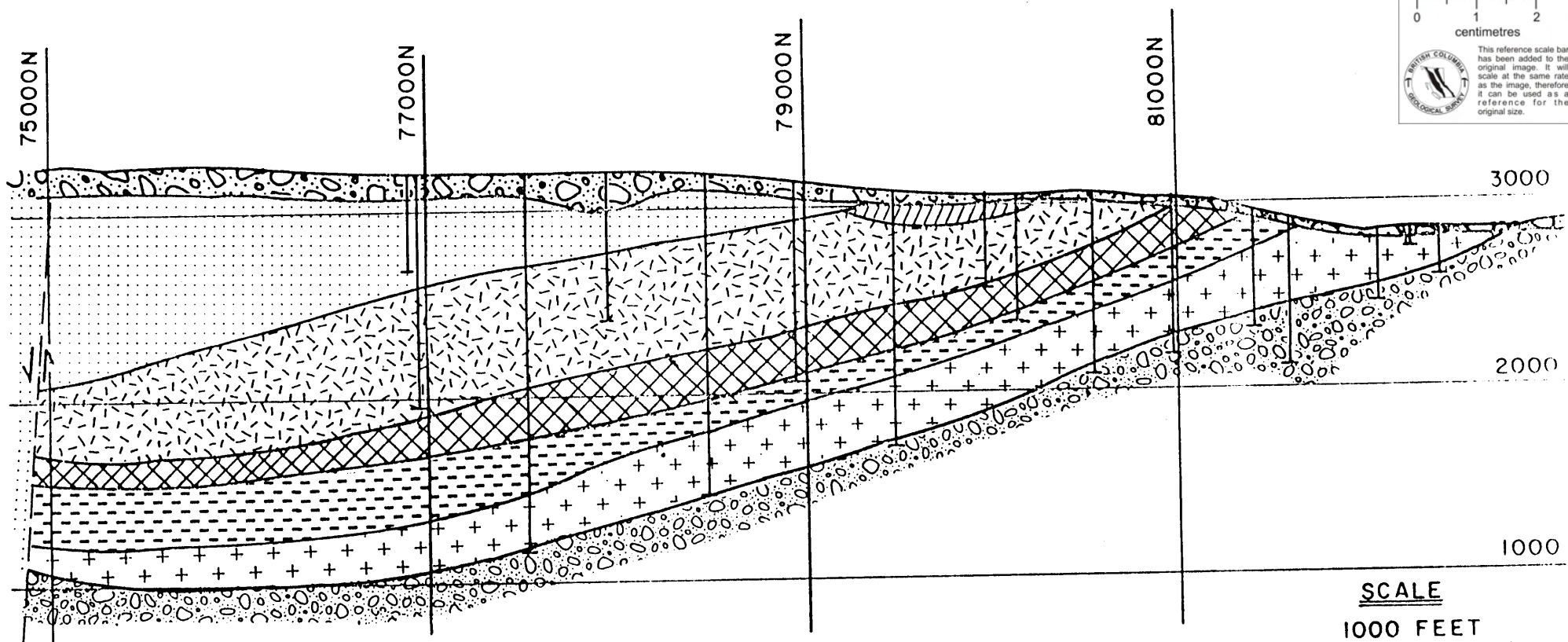
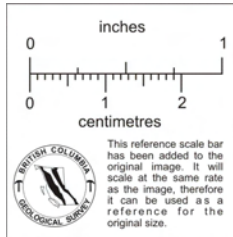
 This reference scale bar has been added to the original image. It will scale at the same rate as the image, therefore it can be used as a reference for the original size.

Figure 4-10









B.C. HYDRO and POWER AUTHORITY

HAT CREEK

Section 77000 N



LEGEND

-  OVERBURDEN
 -  BURN ZONE
 -  HANGING WALL SEDIMENTARY ROCKS
 -  A - ZONE
 -  B - ZONE
 -  C - ZONE
 -  D - ZONE
 -  FOOT WALL SEDIMENTARY ROCKS
- } COAL ZONES



 FAULT WITH RELATIVE MOVEMENT
 DRILL HOLE
 ELEVATION AND COORINATES
 IN FEET

Figure 4-1

B.C. HYDRO and POWER AUTHORITY

HAT CREEK

Section 19500E

Area - South

	Rock Type	Zone	Bent. as % of Total clay
74 - 24 - 348.0 - 350.0 -	gy - brn. clayst.	- Hanging Wall	- 87.65

Area - Centre

	Rock Type	Zone	Bent. as % of Total clay
74 - 44 - 1600	- bentonitic sst. Thick high clay portion.	- C.	- 91.49

Area - South

	Rock Type	Zone	Bent. as % of clay.
76 - 123 - 399.0 - 402.0	gy claystone	Hanging Wall	95.83

Area - West

		high clay content		Bent. as % of clay.
		Rock Type	Zone	
76 - 124	- 190.0 - 200.0	- siltstone	- C	- 90.57
	352.0 - 368.0	- siltstone	- C	- 58.14
	435.0 - 442.0	-calcareous silt & coal	-C	- 20.00
	462.0 - 482.0	- carb. clayst.	- C	- 69.23
	540.0 - 560.0	-carb. clayst. & siltst.	-C	- 52.54
	670.0 - 690.0	- coal	- D	- 13.92 ?
	906.0 - 917.0	- siltstone	- Footwall	- 84.81

Area - Centre (Eastward)

	Rock Type	Zone	Bent. as % of clay.
76 - 126 - 200.0 - 210.0	- siltstone	- Hanging Wall	- 100.00
486.0	- tan <u>ash</u>	- " "	- 100.00
500.0 - 510.0	- siltstone	- " "	- 98.30
677.0 - 679.0	- tan to grey <u>ash</u> -	- " "	- 100.00
- 754.0	- tan to grey <u>ash</u> -	- " "	- 100.00
790.0 - 800.0	- siltstone	- " "	- 35.71
853.0 - 869.5	- coal, clayey coal-	A	- 0.0
921.0	- tan <u>ash</u>	A	- 0.0
993.0 - 1013.0	- clean coal	A	- 11.86 ?

Area - West

	Rock Type	Zone	Bent. as % of clay.
76 - 127 - 250 - 270	- mixed detritals	- C	- 100.00
309 - 311.5	- clayst. siltst., shaly coal	- C	- 100.00
369.0 - 387.0	- coal (Mod.clay)	- D	- 28.24 ?
502.0 - 511.0	- silty clayst.	- Footwall	- 70.45

Area - East

		Rock Type	Zone	Bent. as % of clay.
76 - 128 -	- 386.0	sh'd carb. clayst. high clay interval for 6.0+ feet.	- C	- 15.38

Area - South

		Rock Type	Zone	Bent. as % of clay.
76 - 130 -	- 1621.3	- claystone	- Hanging Wall	- 100.00
	- 1790.5	- "	- " "	- 100.00

Area - Centre

	Rock Type	Zone	Bent. as % of clay.	
76 - 135 - 150.0 - 166.0	- claystone	- Hanging Wall	- 75.19	
213.0 - 222.0	- "	- " "	- 94.34	
280.0 - 288.0	- "	- " "	- 85.47	
296.0 - 301.0	- "	- " "	- 42.07	
304.0	- cream <u>ash</u>	- " "	- 100.00	
329.0 - 331.0	- claystone	- " "	- 55.87	
358.0	- grey <u>ash</u>	- " "	- 100.00	
441.0	- claystone	- " "	- 71.43	
463.0	- "	- " "	- 100.00	
534.1 - 534.5	-	- A	- 41.33	
535.0 - 545.0	- coal	- A	- 50.00	
557.5 - 557.7	-	- A	- 59.17	
594 - 595	- coal	- A	- 33.78	
598.0 -	- sandstone	- A	- 19.23	
661.0 - 661.3	-	- A	- 21.23	
685.0 - 695.0	-	- A	- 2.99	
695.0 - 705.0	-	- A	- 2.55	
722.0 - 726.0	- sl. carb. claystone	- A	- 0.0	
742.0 - 744.0	- carb. clay.	- A	- 0.0	
751.0	- siltstone	- A	- 40.74	} 3' 6' high clay intervals ?
786.0 - 790.0	- carb. clay.	- A	- 36.67	
867.0 - 871.0	- coaly clay.	- A	- 62.00	
935.0 - 945.0	-	- A	- 1.77	
945.0 - 955.0	-	- A	- 0.55	

Area - Centre

	Rock Type	Zone	Bent. as % of clay.
76 - 135 - 938.0 -	siltstone	A	0.0
970.0 -	carb. clayst.	A	0.0
1016.0 - 1035.0-	clayst. some carb.	A	40.00 - ?
1035.0 - 1055.0-	clayst. some carb.	A	0.0
1055.0 - 1082.0-	clayst. some carb.	A	44.17 - ?
1090.0 - 1095.0-	carb. clayst.	A	0.0
1115.0 - 1116.0-	coaly clayst.	B	0.0
1145.5-	<u>ash</u> tan w/minor mottles	B	0.0
1184.5-	coaly claystone	B	0.0
1185.0 - 1195.0 -		B	0.0
1195.0 - 1205.0 -		B	0.0
1208.0 - 1214.0 -	coaly claystone	B	0.0
1240.5 -	coaly claystone	B	0.0
1246.0 - 1253.0 -	coaly claystone	B	4.35
1271.0 - 1275.0 -		B	3.03
1325.0 - 1330.0 -		B	0.0
1330.0 - 1335.0 -		B	0.0
1390.0 - 1397.0 -	<u>tuffaceous</u> siltst.-	C	6.67
1420.0 - 1451.0 -	tuffaceous siltst.-	C	0.0
1451.0 - 1472.0 -	coaly clayst.	C	0.0
1490.0 - 1514.0 -	carb. clayst.	C	0.0
1600.0 - 1610.0 -	carb. clayst.	C	0.0

Area - Centre

	Rock Type	Zone	Bent. as % of clay.
76 - 135 - 1749.0 - 1750.0	silty coal	- D	- 0.0
1751.0 -	- buff <u>ash</u>	- D	- 0.0
1790.0 - 1795.0	coal	- D	- 0.0
1795.0 - 1800.0	coal	- D	- 0.0
1944.0 -	- carb. clay.	- Footwall	- 0.0
1994.0 -	- <u>tuffaceous</u> clay.	- Footwall	- 14.29

Area - Centre

	Rock Type	Zone	Bent. as % of clay.
76 - 136 -	- 195.0 - white <u>ash</u>	- Hanging Wall	- 98.00
	- 219.0 - grey <u>ash</u>	- Hanging Wall	- 87.14
	- 219.0 - 221.0 - grey brn. claystone	- Hanging Wall	- 87.78
	- 308.5 - grey carb. claystone	- Hanging Wall	- 90.48
	- 905.0 - 910.0 - coal	- B	- 0.0
	- 910.0 - 920.0 - coal	- B	- 0.0
	-1639.0 - carb. claystone	- Footwall	- 0.0

	Rock Type	Zone	Bent. as % of clay.
76 - 144 -	- 442.0 - tan <u>tuff</u> (low S.G.) -		- 65.91

Area - South

	Rock Type	Zone	Bent. as % of clay.
76 - 154 -	- 946.0 - calcareous siltst.	- Hanging Wall	- 100.00
	- 946.5 - f.g. sandst.	- Hanging Wall	- 74.42

Area - East

	Rock Type		Zone		Bent. as % of clay.
76 - 157 - 556 - 576 -	coal	-	D	-	0.0

Area - East

	Rock Type	Zone	Bent. as % of clay.
76 - 163 - 376.0 - 396.0 -	coal	D	0.0
438.0 - 446.0 -	carb. claystone	Footwall	0.0

Area - East

	Rock Type	Zone	Bent. as % of clay.
76 - 164 - 253.0 - 273.0 -	clayey coal interbedded coal & partings	A	12.77

Area - South

Rock Type	Zone	Bent. as % of clay.
76 - 170 - 704.0 - 705.0 - Bl.-gy. clayst.	- Hanging Wall	- 100.00

Area - East

	Rock Type	Zone	Bent. as % of clay.
76 - 177 - 254 - 264 -	coaly claystone	D	0.0

Area - Centre

	Rock Type	zone	Bent. as % of clay.
76 - 180 - 125.0 - 145.0	calcareous carb. clayst.	C	0.0
- 207.5	pale → dk. tan <u>ash</u>	C	0.0
321.0 - 322.0	coaly claystone	D	0.0
323.5	pale tan <u>ash</u>	D	0.0
643.0 - 647.0	coaly claystone	D	35.21 ?

↑ clean coal interval
thick high clay bed. 28'
Maybe base of C zone.

Area - East

	Rock type	Zone	Bent. as % of clay.
76 - 181 -	- 254.0 - coaly claystone	- C	- 0.0
	- 295.0 - 297.0 - carb. claystone	- C	- 0.0
	- 492.0 - <u>tuffaceous</u> siltstone	- D	- 0.0
	- 716.0 - 717.0 - carb. claystone	- D	- 2.74
	- 786.0 - 791.0 - clayst. to carb. clayst.	- Footwall	- 0.0

Area - West

	Rock Type	Zone	Bent. as % of clay.
76 - 188 - 58.0 - 75.0 -	carb. claystone	C ← thick claystone	63.69
217.0 - 237.0 -	coal	D	2.30

Centre

	Rock Type	Zone	Bent. as % of clay.
76 - 191 - 226.0 - 232.0 -	clayst.→carb. clayst-	A -	22.37
238.6 - 238.9 -		- A -	28.57
262.0 - 263.0 -	clayst.→carb. clayst-	A -	40.32
297.0 - 299.0 -	clayst.→carb. clayst-	A -	28.41
298.2 - 298.5 -		- A -	31.52
347.0 - 348.0 -	carb. claystone	- A -	24.21
367.0 - 370.0 -	carb.to coaly clayst.-	A -	44.25
388.1 - 388.4 -		- A -	18.07
434.0 - 435.0 -	coaly to carb. clayst-	A -	22.08
464.7 - 465.0 -		- A -	43.37
517.0 - 520.0 -	coaly claystone	- A -	12.00
537.8 - 538.1 -		- A -	56.72
563.0 - 573.0 -	coal,coaly clay.,sst.-	A -	14.58
645.0 - 645.5 -		- B -	0.0
706.2 - 706.5 -		- B -	0.0
744.7 - 745.0 -		- B -	0.0
809.1 - 809.5 -		- C -	0.0
895.1 - 895.6 -		- C -	0.0
950.2 - 950.8 -		- C -	0.0
1072.0 - 1073.0 -	coaly claystone	- D -	0.0
1134.0 - 1135.0 -	coaly claystone	- D -	0.0
1285.6 - 1286.0 -		-Footwall -	0.0

Area - Centre

	Rock Type	Zone	Bent. as % of clay.
76 - 194 - 50.0 - 70.0 -	coal	D	0.0
170.0 - 191.0 -	coaly clayst., clayst.	Footwall	0.0

Area - Centre

	Rock Type	Zone	Bent.as % of clay.
76 - 196 -	- 300.0 - buff <u>ash</u>	- B	- 0.0
	- 300.0 - 301.0 - carb. clay. ^{thin clay Bed}	- B	- 22.73 ?
	- 368.0 - <u>tuffaceous</u> silt.-	B	- 4.17
	- 522.0 - carb. clayst.	C	- 0.0
	- 771.0 - sl. carb. clayst.	D	- 0.0
	- 883.0 - 887.0 - carb. clayst.	D	- 0.0

Area - Centre

Rock Type	Zone	Bent. as % of clay.
76 - 204 - 491.0 - 495.0 - sl. carb. clayst.	- D ↑ probably footwall	- 31.43

PTMC

inter-office memo 

MEMO TO: M. A. FAVELL

14 February 1978

FROM: P. T. McCULLOUGH

File: 1301.2
213.1

SUBJECT: Progress Into the Uses of Coal By-Products From Hat Creek

Five studies are examining the uses of coal by-products from Hat Creek:

1. Kaolin - being conducted by Drs. A. C. D. Chaklader and I. H. Warren. A bulk sample from trench B (360 kg) has been homogenized and sampled. Initial indications are that this is an exceptionally good clay with a high kaolin content and as a result a high vitrification temperature. Therefore it could produce excellent refractory material. Samples have been sent to Clayburn Industries to undergo tests which U.B.C. cannot do. Additional samples of washery rejects have been requested by Dr. Chaklader in order to determine if this material contains clay of similar quality. Completion of the tests is expected on 31 August 1978.
2. Alumina extraction - being conducted by Dr. A. Winer of the Industrial Minerals Laboratory, Ottawa. A bulk sample of laboratory rejects is being sent from Commercial Testing Ltd. The sample is from DDH 76-191 and is considered to be representative of the kaolinitic clays. The extraction of alumina from the clay will be examined and compared with extraction of alumina from ash produced in a fluidized bed system being constructed at EMR. In addition Dr. Winer has received two samples of bentonitic clay, one from DDH 76-126 and the other from trench A. He will examine the cation exchange capacity of the clay and its potential as a source of bentonite. The completion date is unknown.
3. Bentonite - being conducted by [REDACTED] [REDACTED] is interested in bentonite throughout Canada. They are currently examining data collected from B. C. Hydro in order to devise a sampling program to examine the bentonitic clays from Hat Creek. The completion date is uncertain, but it is expected to finish by 30 June 1978.
4. Baked clay - being conducted by Clayburn Industries Ltd. Four channel samples were collected from trench A at Hat Creek. Initial indications are that the material is a good substitute for artificially calcined clay. Results are expected within the next week.

...2

10 February 1978

- 2 -

Memo to: M. A. Favell

5. Fly Ash - Two investigations are being conducted independently by Wescon Products Ltd. (a division of Ocean Cement) and Lafarge. They are examining the pozzolanic properties of fly ash from the Battle River test burn. Initial chemical tests were favourable. A test of the 28-day compressive strength is underway. Results are expected next week.

If results are favourable each of these investigations could continue.

PTMc:rak

cc: P. R. Willis
C. R. Welton
M. H. French
R. M. Woodley

Larry McLaughlin



COPIES

PROJECT Hat Creek Thermal	DATE 6/10/80	FILE 604H
FROM Robert Zaniol	Co. McMillon-Bloedel	TEL# ^{Local 2159} 683-6711
TO Terry McCullough	Co. BCHA	TEL# 663-4056
SUBJECT Kaolin Clay From Hat Creek		

PRW
AMW

DISCOURSE Mr. Zaniol noted that total use for kaolin clay in the Pacific Northwest (U.S.A. & Canada) is approximately 200,000 t/a as paper filler. M&B currently use a clay to wood fibre mixture of 50:50 in their newsprint; the percentage of clay is expected to increase because the cost of wood fibre is increasing faster than the cost of clay. M&B currently imports clay in suspension in railroad tank cars at approximately \$70 (Can.) per dry tonne, of which half is for the cost of transportation. Because of expected increased costs for transportation and ~~the~~ clay (because of increased demand) a local source of clay would be desirable - hence the interest in Hat Creek.

The problem is with Hat Creek clay, as far as is known from the study by Mrs Howard of B.C. Research, is that the brightness is low at approximately 46%, compared with 80% for Georgia kaolin and a minimum of 60% ^{required} for newsprint manufacture. The value of 46% is for bleached, sedimented (with 80% recovery of clay by weight) Hat Creek clay. Mr Zaniol believes that this figure may be improved if ~~it was~~ ^{producers} worked on it, so he is sending a letter to Mr H.J. Soldie recommending some producers and agrees to assist in establishing contact.