B.C. HYDRO

HAT CREEK PROJECT

MINING FIELD PROGRAM 1982

SUMMARY REPORT

STATION PROJECTS DIVISION

THERMAL ENGINEERING DEPARTMENT

June 1983

BR29

HAT CREEK PROJECT

MINING FIELD PROGRAM 1982

SUMMARY REPORT

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SECTION 1.0 - INTRODUCTION

Following the 1981 Site Investigations Program (SIP 81) it was decided to continue preliminary site investigations into aspects affecting the various areas i.e. Powerplant, Mining and Environmental, under Site Investigations Program 1982. The Mining Department and specialist consultants planned various mining programs which were to provide necessary information in key areas. The mining program was designated as the Mining Field Program 1982 (MFP'82) and as originally planned comprised the following six work programs:

1. Hat Creek Diversion Tunnel Investigations
2. Groundwater and Geotechnical Update
3. 'A' and 'C' Zone Coal Bulk Sample
4. Coal Characteristics Evaluation
5. Claystone Investigations
6. Geological and Geophysical Investigations

The work programs were all to be carried out within the boundaries of the 54 Coal Licences registered with B.C. Hydro, and under the approved Reclamation Permit #103, as per the terms of the Coal Mine Regulation Act.

A decision was made in July 1982 by the B.C. Hydro Board of Directors to defer the Hat Creek Project indefinitely. This resulted in budget restraints being imposed during both the planning and execution of the programs. This eliminated the following programs:

1. Excavation of Claystone Trench
2. 'C' Zone Coal Bulk Sample
3. Geological and Geophysical Investigations

and reduced the following:

1. Groundwater and Geotechnical Update
2. 'A' Zone Coal Bulk Sample
3. Coal Characteristics Evaluation

The field programs planned for Powerplant and Environmental investigations were cancelled entirely as a result of the deferral, therefore, the 1982 field program was concerned only with mining aspects.

The final program of work was completed on time, under revised budget, and provided information for the 800 MW mine plan developed in 1982.

The deferment of the Project also resulted in the decision to close down the Hat Creek Site upon completion of the MFP'82. Certain monitoring and inspection programs will continue as required by the Coal Mines Regulation Act. As no further field programs are envisaged for some time it was decided to dispose the site offices, camp and other assets through a disposal sale.

SECTION 2.0 - SUMMARY

This report is intended to describe the results of the field programs which are covered in more detail in the various reports referenced in Section 5.0.

Technical summaries of these reports are given in Section 4.0.

2.1 SCHEDULE AND PROGRAMS

MFP'82 was started in April 1982 with the opening and preparation of the site and facilities, with program planning being carried out in Vancouver. All site work was completed by the end of September 1982 except for the disposal sale and on-going maintenance which was carried through to the end of March 1983.

The various field programs were carried out under the overall control and supervision of the B.C. Hydro Site Manager, W.C. Fothergill, P. Eng. Direct supervision of the individual programs was carried out by Golder Associates for the programs (a) and (b) below, and by B.C. Hydro and/or Jackson Payne Consultants for programs (c), (d) and (e). Fig. 2-1 shows the various areas of work in the Hat Creek Valley.

(a) Hat Creek Diversion Tunnel Investigations

Geophysical surveys; geological and geotechnical drilling; and geological mapping of possible routes:

Consultant	-	Golder Associates
Drill contractor	-	D.W. Coates Enterprises

Rig	-	Rotary core; Longyear 44 skid mounted
Holes drilled	-	5
Metres drilled	-	917 HQ
Magnetic and Resistivity Survey	-	Geo-Physi-Con
Down-hole Geophysical Survey	-	Roke Oil Ltd.

(b) Groundwater and Geotechnical Update

Geophysical survey; geotechnical and hydrological drilling in Hat Creek valley; materials testing; seismic analysis:

Consultant	-	Golder Associates
Drill contractor	-	Drillwell Enterprises
Rig	-	Air/rotary; BE24R truck mounted
Holes drilled	-	2
Metres drilled	-	390.2

(c) 'A' Zone Coal - Bulk Sample

Overburden stripping; geophysical survey; coal excavation crushing and blending; coal preparation testing:

Contractors (Trench Excavation)	-	H.E. Sanders Ltd. c/w D8Cat and 4 motorscrapers JD 762, TEREX TS14B
	-	A. Watson Enterprises - P&H418 2 cu. yd.
	-	Trucks - 2 @ 12 yd. F.E.L. - Cat 966

Coal crushing	-	Cedar Rapids Jaw Crusher, 30" wide feed conveyor Feed hopper, Cat 966
Contractor (operating)	-	Pavillion Lake Contracting
Supervision	-	Jackson - Payne Consultants Ltd. & B.C. Hydro Mining
Geophysical survey	-	Roke Oil Enterprises Ltd.
Overburden removed	-	120448 BCM
Coal excavated	-	7677 BCM (11400 tonnes)
Coal preparation Tests	-	EPRI Homer City Pa, Coal Cleaning Test Facility - 160 t sample
	-	KHD Humboldt-Wedag W. Germany 10 t sample (Batac Jig)

(d) Coal Characteristics Evaluation

Study of coal samples for sodium analysis and distribution:

Consultants	-	S. Fadl/J.M. Berry (SFU/BCIT)
	-	Dr. Chaklader - UBC
Laboratories	-	B.C. Hydro Site, P.K.B. Scandia

(e) Claystone Investigation

Perform excavation and crushing tests:

Contractor	-	Art Watson Enterprises
Testing	-	Hazemag Canada Ltd. Test Laboratory
Supervision	-	B.C. Hydro Mining Dept.

2.2 CONCLUSIONS

The various programs provided useful information for the on-going studies into various aspects of the Hat Creek Project. Information regarding the Hat Creek Diversion, pit slope stability, slope angles, hydrology and coal quality predictions were used in the 800 MW study and in the 2240 MW update. Detailed information on all programs is given in Section 4.0.

(a) Hat Creek Diversion

Several options were investigated and the selection of a pipeline diversion was recommended. This selection satisfied pit safety requirements as well as minimizing costs.

(b) Groundwater and Geotechnical Update

Although curtailed by budget restraints, further information was gathered on the groundwater regime, allowing water inflow estimates to be made. Geotechnical reassessments allowed for more reliability in former predictions of pit slope stability and of the waste embankment stability.

(c) 'A' Zone Coal Bulk Sample

Sufficient work was carried out in this program to give further reliability to the geological interpretation of the No. 1 deposit. Selective mining was shown to be practical and achievable. Sampling and blending techniques were confirmed and the coal cleaning tests were successful. The coal handling tests indicated that with careful design, materials handling problems could be minimized or eliminated.

(d) Coal Characteristics Evaluation

Further information was obtained on the occurrence of sodium in Hat Creek coal. Budget restrictions limited the scope of work in the program.

(e) Claystone Investigations

Although the main program was cancelled, access to Medicine Creek claystones was possible in 'A' Zone coal trench. A sample was shipped to Hazemag Canada for crushing tests and no problems were noted other than that moisture levels in the claystones can be critical.

2.3 FUTURE WORK

The deferment of the Project has delayed indefinitely any future field programs. The monitoring of piezometric water levels and gathering of environmental data will continue at a low level, and site inspections will carry on for safety and security reasons.

Further work has been recommended into geotechnical and hydrological aspects as well as coal quality and trace element studies. The excavation of a bulk sample of 'C' Zone coal in saturated ground conditions is also recommended to test selective mining and coal handling characteristics. However, it was decided to close down the site, dispose of certain office trailers, camp buildings, etc. An 8-foot high security fence was erected around the core sheds and permanent structures. Site inspection and monitoring will continue as required by the Coal Mines Regulation Act. Mr. W.C. Fothergill, P.Eng., former Site Manager, has been retained to carry out these duties, and Pavillion Lake Contracting has been contracted to provide labour and equipment to carry out any remedial work required.

(a) Safety

The safety aspects of the programs were in accordance with the Coal Act and no major lost time accidents were reported. Hazardous areas were marked and fenced at the end of the field activities as requested by the Inspector of Mines as part of the Site closure procedures.

(b) Labour

The main contractors and consultants and peak number of personnel engaged in the various program were as follows:

H.E. Sanders	-	5
D. Coates Drilling	-	4
Drillwell	-	3
Pavillion Lake	-	11
A. Watson Enterprises	-	1
Equipment Rental Contractors	-	4
Golder Associates	-	4
Klohn Leonoff	-	2
Gallant Water Trucking	-	1
Westmark Engineering	-	2
B.C. Hydro	-	6
Jackson-Payne Consultants	-	1
Maximum Employed		44

(c) Reclamation and Pollution Control

All drill sites and trails were harrowed and seeded upon completion of the programs. Ditches and containment berms were erected around coal and coal waste piles. Sumps were installed to collect drain-

age in the test trench. A separate report giving details of the reclamation work is referenced in Section 5.0.

A study on fugitive dust emissions from Trench D was also carried out by the B.C. Hydro ESS Department. This report is referenced in Section 5.0.

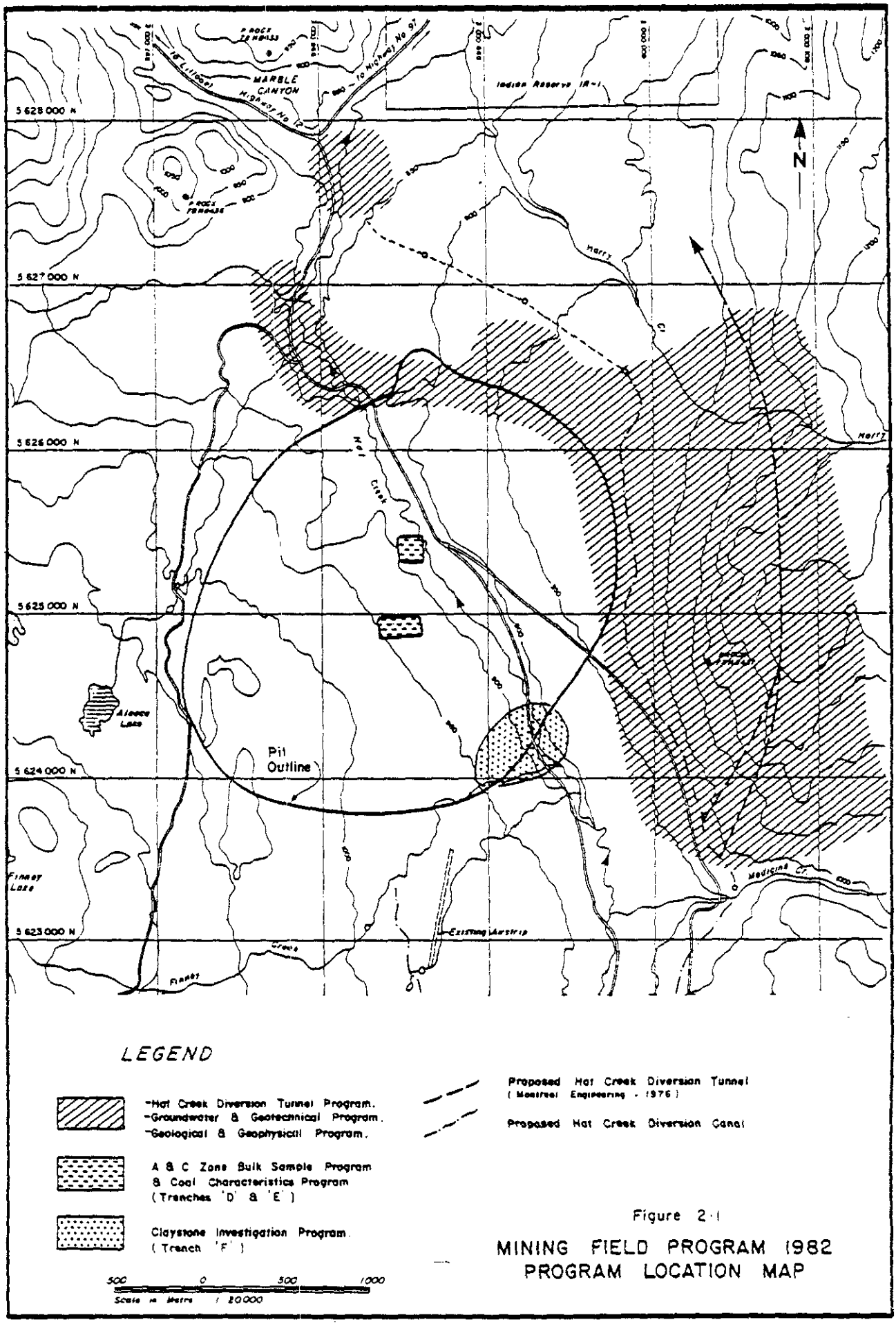

Figure 2-1

MINING FIELD PROGRAM 1982
PROGRAM LOCATION MAP

SECTION 3.0 - COSTS

3.1 INTRODUCTION

The original budget for the planned full program of work was in excess of $3 million, this was reduced successively to $2.0 million and then $1.67 million by eliminating and/or reducing certain programs prior to field activities commencing. Table 3-1 gives these original budgets. However, following the deferral of the Project further cuts were necessary but these were planned so as not to effect the overall objectives of the programs, nor waste any monies already spent.

The final budget was established at $1.427 million and the final costs of the programs was $1.25 million which included routine maintenance costs through to the end of March 1983. These costs are summarized by PARR account number in Table 3-2.

Other indirectly applicable PARR costs including site closure costs are given in Table 3-3. Total expenditures in the Mining PARRS 750263/ 823901 to the end of March 1983 were $1.52 million against a budget of $1.850 million.

3.2 COST CONTROL

One of the key areas in carrying out successful field programs, especially in times of budget restraint, is cost control. In previous programs, this has been achieved by close on-site control of consultants and contractors by requiring daily log sheets to be submitted to the Site Manager who maintained cost control records.

However, in order to test the usefulness of the Mining Subject Index (M.S.I.) it was decided to monitor costs in parallel with the existing system, using the M.S.I. accounts, applying them against the various programs, and using unit costs for quantities, manhours, equipment hours, etc., this allows actual costs to be collected and not merely invoiced costs.

This involved some inconveniences due to the fact that B.C. Hydro accounting utilizes the PARR accounts which collects and allocates costs in a different manner. However, the use of the M.S.I. was somewhat effective in that it allowed the daily expenditures to be monitored, forecasts to be made, and also for costs to be allocated accurately. Table 3-4 shows the M.S.I. breakdown and format of collecting costs to the end of August 1982 the last month in which the system was used.

3.3 PROGRAM COSTS

The respective program direct costs are summarized below. These costs do not include such items as camp costs, vehicles, etc. which were collected separately under field services shown in (f) below.

(a) Hat Creek Diversion

Consultants:	Engineering Office	=	$ 102,618
	Field Supervision	=	90,160
Drilling		=	143,258
Geophysical		=	2,991
			$ 339,027

(b) Groundwater and Geotechnical Update

Consultants:	Engineering Office	=	$ 95,627
	Field Supervision	=	26,556
Drilling		=	57,137
Pump Test (cancellation charge)		=	5,500
			$ 184,820

(c) 'A' Zone Coal-Bulk Sample

Excavation:	Site Preparation	=	$ 5,638
	Overburden	=	153,232
	Coal and Trucking	=	31,294
	Geophysical Logging	=	1,244
	Supervision and Surveyor	=	15,105
Coal Crushing:	Equipment	=	16,610
	Materials	=	6,630
	Labour	=	17,850
	Assay Laboratory	=	19,520
Coal Testing:	Homer City CCTF	=	70,000
	KHD Wedag	=	24,000
	Kaiser Engineers	=	7,268
Shipping:	Road	=	11,637
	Rail	=	20,120
			$ 401,148

(d) Coal Characteristics Evaluation

Consultants	=	$ 18,465
Laboratories and Testing	=	4,236
		$ 22,701

(e) Claystone Investigations

No charges.

(f) Field Services

Camp Costs	=	$ 44,523
General Maintenance	=	137,274
Reclamation	=	68,310
Vehicles	=	23,653
Ambulance	=	2,438
Fuel	=	12,736
Water Truck	=	13,020
Misc. Freight	=	297
		$ 302,251
TOTAL MFP'82		$ 1,249,947

Table 3 - 1

SIP 82 MINING FIELD PROGRAM
BUDGET ESTIMATES

ITEM	MARCH 1982	BUDGET ESTIMATES 1982 ORIGINAL	REVISED 25 FEB. 1982	REVISED 10 MARCH 1982
FIELD SERVICES				
BUILDING MAINTENANCE/SECURITY		60,000	60,000	60,000
SURVEYING/FIRST AID		24,000	24,000	24,000
ROADS, DRILL SITES		40,000	40,000	40,000
RECLAMATION		60,000	60,000	60,000
CATERING		135,000	100,000	100,000
VEHICLES		24,000	24,000	24,000
FUEL		15,000	15,000	15,000
SERVICES $22,000 IN COST CENTRE				
		358,000	323,000	323,000
PROGRAMS IN ORDER OF PRIORITY				
1. HAT CREEK DIVERSION TUNNEL INVESTIGATION				
GEOPHYSICAL	48,000			
ENGINEERING	66,815	255,110	182,000	182,000
FIELD		345,264	237,300	237,300
	114,815	600,374	419,300	419,300
2. GROUNDWATER EXPLORATION AND GEOTECHNICAL UPDATE				
ENGINEERING	21,185	77,673	64,726	64,726
FIELD		181,260	116,000	116,000
	21,185	258,933	180,726	180,726
3. FINAL REPORT - GOLDER	-	37,227	21,000	21,000
4. "A" ZONE BULK SAMPLE PROGRAM				
TRENCH "D" EXCAVATION		562,500	391,000	361,172
SAMPLING, HANDLING		50,000	50,000	50,000
SHIPPING, WASH TEST		75,000	150,000	150,000
GEOPHYSICAL		15,000	15,000	15,000
PLANT EQUIPMENT		66,000	40,000	40,000
MATERIAL HANDLING TESTS		20,000	20,000	20,000
BATAC JIG TEST		25,000	25,000	25,000
SITE LABORATORY		20,000	10,000	10,000
		833,500	701,000	671,172
5. COAL CHARACTERISTIC EVALUATION PROGRAM		50,000	50,000	50,000
6. CLAYSTONE INVESTIGATIONS				
TRENCH "E" EXCAVATION		320,000	-	
DRILLING AND PIEZOMETERS		-	20,000	
ENGINEERING, SUPERVISION, LABORATORY		40,000	10,000	
		360,000	30,000	-
7. "C" ZONE BULK SAMPLE PROGRAM				
TRENCH "E" EXCAVATION		98,000	20,000	
DRILLING AND PIEZOMETERS		20,000	-	
SAMPLING AND HANDLING		50,000	5,000	
SHIPPING AND WASH TEST		75,000	-	
OTHER TESTS		25,000	5,000	
LABORATORY ANALYSIS		20,000	5,000	
		288,000	35,000	-
8. GEOLOGICAL REASSESSMENT		51,000	11,302	11,302
9. INFILL DRILLING - WASTE DUMPS				
ENGINEERING		56,633	-	
FIELD		109,050	-	
		165,683	-	-
10. GEOLOGICAL MAPPING, GEOPHYSICAL		40,000	-	-
TOTAL	136,000	3,038,863	1,771,328	1,677,300
CONTINGENCY			177,133	-
	136,000	3,038,863	1,948,461	1,677,300

TABLE 3-2

SIP 1982 - MINING FIELD PROGRAM - PARR 750263/823901 - TOTAL COSTS

Acct.	P.O.	Description	Original Estimate	Revised Estimate	Final Costs 31 Mar./83
056	259 832	Chemical Analyses - S.F.U.	18,635	18,635	18,465
	259 838	Groundwater, Geological Reassessment - Golder	279,500	279,500	290,966
	259 841	Coal Analyses - Chemical and Geological Lab.	10,000	10,000	4,236
	259 855	Coal Cleaning Tests - E.P.R.I.	70,000	-	70,103
	259 856	Coal Shipment (150 t) - Arrow Transport	2,000	2,000	1,730
	259 864	Cost Estimate - Coal Plant - Kaiser Engineers	15,000	-	7,268
	S.P.O.	Coal Shipment to Homer City - CP Rail	-	20,121	20,121
	S.P.O.	Motorways	-	-	176
	S.P.O.	Border Brokerage	-	-	21
	S.P.O.	Coal Shipment (10 t) - Consolidated Freightways	-	-	4,233
	S.P.O.	Freight	-	-	4,045
	S.P.O.	Signal Trucking	-	-	991
	L.P.O.F117	Miscellaneous Purchases	-	-	3,234
		Account Total			425,589
103	ERA 53977	Hydraulic Excavator - Art Watson	-	20,000	12,917
	ERA 53978	Front End Loader - Pam-Co-Dan Trucking	-	10,000	7,936
	ERA 53979	Dump Truck - J.C. Reynolds	-	7,000	6,497
	ERA 53980	Dump Truck - Norm's Truck and Loader Service	-	8,400	8,506
	259 817	General Maintenance - Pavillion Lake	30,000	56,400	36,982

TABLE 3-2 - (Cont'd)

Acct.	P.O.	Description	Original Estimate	Revised Estimate	Final Costs 31 Mar./83
103	259 824	Groundwater Exploration - Drillwell	116,000	69,060	57,137
	259 825	Geotechnical Drilling - Coates	172,000	-	143,258
	259 826	Pump Testing - Aqua-Flo (contract cancelled)	38,800	5,500	5,500
	259 829	Overburden Excavation - H.E. Sanders	150,000	160,000	161,016
	259 837	Geophysical Logging - Roke Oil	-	2,450	2,991
	259 838	Geological Reassessment - Golder	24,500	24,500	23,995
	259 843	Modification of Coal Handling Equipment - Westmark	-	5,000	2,597
	259 844	Jaw Crusher - Nelson Machinery	-	15,300	13,120
	259 847	Geophysical Logging - Roke Oil	-	2,400	2,094
	259 848	150 Steel Drums - Can-Am Steel Drums	-	3,200	2,632
	259 850	Plastic Liners - Western Concord	-	-	230
	259 853	Geophysical Logging - Roke Oil	-	1,623	1,623
	259 854	Water for Drilling, Storage Tank, etc. - Gallant Trucking	-	13,020	13,020
	259 859	Coal Cleaning Tests - KDH-Betzc	-	25,000	24,000
	LPO F117	Miscellaneous Charges	-	-	6,125
		Account Total			532,176

TABLE 3-2 - (Cont'd)

Acct.	P.O.	Description	Original Estimate	Revised Estimate	Final Costs 31 Mar./83
801	259 817	General Maintenance - Pavillion Lake	76,000	129,100	137,274
	259 818	Reclamation of Drill Sites, etc. - E. Lehman	92,000	81,500	68,310
	259 820	Vehicles - C-3 Holdings (Can-Ex)	7,000	11,000	13,238
	259 821	Vehicles - SIVA	13,000	13,000	10,415
	259 822	Ambulance - Rosyn Safety	3,000	3,000	2,438
	259 823	Catering - Domco Food	100,000	100,000	44,523
	17 015	Gasoline - Shell	15,000	15,000	12,736
	LPO F117	Miscellaneous Charges	-	-	4,373
		Account Total			293,407
		TOTAL M.F.O. - 1982			1,249,947

TABLE 3-3

SIP 1982 - MINING PARR 750263/823901 (OTHER WORK AND STUDIES) - TOTAL COSTS

Acct.	P.O.	Description	Original Estimate	Revised Estimate	Final Costs 31 Mar./83
055	159877	Fitzpatrick Mining - Consulting Services	63,000	-	47,500
	159878	Bennett and Associates - Consulting Services	-	-	4,651
	159880	Rayfield and Associates - Consulting Services	-	-	5,856
	259831	Mintec Inc. - 800 MW Study	25,000	47,000	46,900
	259834	Wrights Engineers - Consulting Services	80,000	105,000	108,311
	259865	Mintec Inc. - No. 2 Deposit, Calculate Reserves	6,150	-	6,150
		Account Total			219,368
056	259860	Golder Associates - 800 MW Drainage Plan	22,000	-	22,008
		Account Total			22,008
801	259863	Trojan Fencing - Security Fence	16,642	-	15,642
(Site Closure)	WD 194115	Mine Site Fencing Labour Supply	5,224	-	9,224
	LPOF117	Miscellaneous Purchases	-	-	2,406
		Account Total			28,272
		Total			269,648
		MFP'82 Total			1,249,947
		Total PARR 750263/823901			1,519,595

TABLE 3 - 4
SIP 82 MINING FIELD PROGRAM - MINING SUBJECT INDEX

PARR 750263-056 — MINING MONTHLY COST REPORT — PERIOD TO 31 August 1982

COST CODE	DESCRIPTION	BUDGET		UNIT	QUANTITIES		UNIT PRICE		COSTS				VARIANCE UNDERRUN (OVERRUN)
		ORIGINAL	REVISED		TO DATE	FORECAST TO COMPLETE	TO DATE	FORECAST TO COMPLETE	THIS PERIOD	TO DATE	COST TO COMPLETE	FORECAST FINAL COST	
91640	HAT CREEK DIVERSION ENGINEERING												
-2201	-OFFICE LABOUR	91,840	91,840	M/HRS									
-2202	-SITE SUPERVISION	90,160	75,150	M/HRS									
91600	GROUNDWATER ENGINEERING												
-2201	-OFFICE LABOUR	57,080	57,080	M/HRS									
-2202	-SITE SUPERVISION	26,556	16,500	M/HRS									
93000	"A" ZONE BULK SAMPLE		254,934						24,557	~ 235,585	48,000	283,585	(28,651)
-1611	-SHIPPING	47,000	31,000	L.S.					31,000	31,000	NIL	31,000	NIL
-1615	-HOMER CITY TESTS	103,000	69,000	L.S.					NIL	NIL	80,000	80,000	(11,000)
93000	GEOLOGICAL REASSESSMENT												
-2240	-OFFICE LABOUR	14,364	14,364	M/HRS									
93000	COAL CHARACTERISTICS												
-2650	-RESEARCH LABORATORIES	50,000	50,000	L.S.					~ 5,000	24,835	25,000	49,835	165
93000	800 MW PIT												
-2250	-OFFICE ENGINEERING	15,000	15,000	M/HRS					NIL	NIL	NIL	NIL	15,000
-2260	-DRAINAGE STUDY	NIL	NIL						NIL	NIL	25,000	25,000	(25,000)
	TOTAL	495,000	419,934						60,557	291,420	178,000	469,420	(49,486)

TABLE 3 - 4 (Cont'd)
SIP 82 MINING FIELD PROGRAM - MINING SUBJECT INDEX

PARR ACCOUNT 750 263 103 — MINING MONTHLY COST REPORT — PERIOD TO 31 August 1982

COST CODE	DESCRIPTION	BUDGET ORIGINAL	BUDGET REVISED	UNIT	QUANTITIES TO DATE	QUANTITIES FORECAST TO COMPLETE	UNIT PRICE TO DATE	UNIT PRICE FORECAST TO COMPLETE	COSTS THIS PERIOD	COSTS TO DATE	COST TO COMPLETE	FORECAST FINAL COST	VARIANCE UNDERRUN (OVERRUN)
91640	HAT CREEK DIVERSION												
-1600	-DRILLING	95,600	79,700	M									
-1601	-MOBILIZE, DEMOBILIZE	2,850	2,850	L.S.									
-1200	-STANDBY AND RELOCATION	22,250	18,550	HR.									
-1400	-MATERIALS, EQUIPMENT, CONSUMABLES	50,750	42,300	MTH.					NIL	144,178	NIL	144,178	(778)
			143,400										
-1600	-GEOPHYSICAL	24,500	24,500	L.S.					NIL	24,500	NIL	24,500	NIL
91600	GROUNDWATER EXPLORATION												
-1600	-DRILLING	79,400	45,660	M									
-1601	-MOBILIZE, DEMOBILIZE	7,000	5,000	L.S.									
-1602	-WELL COMPLETION	8,250	4,750	HR.									
1400	-MATERIALS, CONSUMABLES	17,300	9,950	MTH.					NIL	57,137	NIL	57,137	11,923
			69,060										
-1200	-STANDBY, RELOCATION	6,450	3,700	HR.									
1603	PUMP TEST	36,750	6,000	HR.					NIL	5,500	NIL	5,500	500
93000	TRENCH "D" EXCAVATION												
1610	-OVERBURDEN REMOVAL	146,900	146,900	M^3					NIL	161,016	NIL	161,016	(14,116)
-1511	-COAL MINING	80,000	80,000	M^3					18,830	36,430	NIL	36,430	43,570
-1513	-MISCELLANEOUS WORK	82,000	62,000	EQPT./HR.					2,450	21,552	13,000	34,552	27,448
-1311	SAMPLING (DRUMS ETC.)	5,000	5,000	LOT					NIL	3,100	NIL	3,100	1,900
-3211	-SAMPLING (LABOUR)	30,000	30,000	M/HR.					4,130	8,070	NIL	8,070	21,930
1514	-SAMPLING (EQPT. RENTAL)	15,000	15,000	EQPT./HR.					2,556	3,252	NIL	3,252	11,748
-1515	-GEOPHYSICAL (EQPT. RENTAL)	2,000	2,000	EQPT./HR.					NIL	NIL	NIL	NIL	2,000
-1612	-GEOPHYSICAL	13,000	13,000	DAY					NIL	7,064	NIL	7,064	5,936
-1512	-PLANT EQUIPMENT	40,000	40,000	MTH.					4,800	16,350	7,820	24,170	15,830
-1613	-MATERIAL HANDLING TEST	20,000	-	L.S.					-	-	-	-	-
-1614	-BATAC JIG TESTS	25,000		L.S.					5,000	5,000	20,000	25,000	(25,000)
-1312	-LABORATORY MATERIALS	10,000	10,000	MTH.					200	1,800	200	2,000	8,000
-1620	-TRENCH "E" EXCAVATION	20,000	-	M^3					-	-		-	-
-1621	SAMPLING, TESTING	15,000	-	L.S.					-	-	-	-	-
-1215	-LABORATORY LABOUR		20,000						5,880	19,320	840	20,160	(160)
	TOTAL	855,000	666,860						43,846	514,269	41,860	556,129	110,731

TABLE 3 - 4 (Cont'd)
SIP 82 MINING FIELD PROGRAM - MINING SUBJECT INDEX

PARR ACCOUNT 750 263 801 — MINING MONTHLY COST REPORT — PERIOD TO 31 August 1982

COST CODE	DESCRIPTION	BUDGET		UNIT	QUANTITIES		UNIT PRICE		COSTS				VARIANCE
		ORIGINAL	REVISED		TO DATE	FORECAST TO COMPLETE	TO DATE	FORECAST TO COMPLETE	THIS PERIOD	TO DATE	COST TO COMPLETE	FORECAST FINAL COST	UNDERRUN (OVERRUN)
98610													
-5200	MAINTENANCE - LABOUR	75,000	72,000	M/HR.									
-5400	MAINTENANCE - VEHICLES, SMALL TOOLS, CONSUMABLES & SUPPLIES	10,700	10,700	-									
-5500	MAINTENANCE - EQUIP'T RENTAL	15,600	10,000	HR.									
			129,100						14,418	95,597	45,000	140,597	(11,497)
98130													
-1200	SURVEYING, FIRST AID - LABOUR	34,400	34,400	M/HR.									
-1400	SURVEYING, FIRST AID - VEHICLES, SMALL TOOLS, CONSUMABLES AND SUPPLIES	2,000	2,000	-									
98450													
-1200	ROADS, DRILLSITES - LABOUR	6,800	5,000	M/HR.									
-1400	ROADS, DRILLSITES - VEHICLES, SMALL TOOLS, CONSUMABLES AND SUPPLIES	1,700	1,700	-									
-1500	ROADS, DRILLSITES - EQUIPMENT RENTAL	34,500	28,000	HR.									
			81,500						12,486	51,599	18,000	65,599	11,901
98290													
-1200	RECLAMATION - LABOUR	10,200	6,700	M/HR.									
-1400	RECLAMATION - VEHICLES, SMALL TOOLS, CONSUMABLES & SUPPLIES	2,100	2,100	-									
-1500	RECLAMATION - EQUIP'T RENTAL	46,000	38,000	HR.									
98620													
-1600	CATERING SERVICES	93,400	85,000	CAMP DAY									
			91,600						10,285	44,523	10,000	54,523	37,077
-1600	CATERING CASUAL MEALS	6,600	6,600	EACH									
99800													
1400	VEHICLES - FUEL, SUPPLIES	15,000	15,000	MTH.					600	4,514	3,000	7,514	7,486
-1500	VEHICLES - RENTAL	24,000	24,000	UNIT MTH.					6,000	23,852	5,524	29,376	(5,376)
	TOTAL	378,000	341,200						43,789	220,085	81,524	301,609	39,591

SECTION 4.0 - TECHNICAL SUMMARY

This section presents the findings and conclusions of the various work programs in MFP'82. The summaries are taken directly from the various reports referenced in Section 5.0.

4.1 HAT CREEK DIVERSION TUNNEL INVESTIGATION PROGRAM

Golder Associates
CONSULTING GEOTECHNICAL AND MINING ENGINEERS

REPORT TO
B.C. HYDRO
ON THE
HAT CREEK PROJECT
DIVERSION STUDY
FINAL REPORT

VOLUME 1 - MAIN TEXT

DISTRIBUTION:

10 copies - B.C. Hydro
Vancouver, British Columbia

3 copies - Golder Associates
Vancouver, British Columbia

December, 1982

822-1523B

SUMMARY AND CONCLUSIONS

This Appendix gives an account of the work that was carried out during 1982 on the tunnel aspects of potential creek diversions at Hat Creek.

Previous work for the 2000 MW Pit showed that it would be necessary to move the proposed canal diversion into the tunnel approximately in Year 14, when the pit had encroached eastward to such an extent that the safety of the canal was jeopardized. No detailed investigation was carried out to assess the viability or cost of a tunnel diversion at that stage.

The 1982 studies, which examined the various methods of diversion for both the 2000 MW and the 800 MW Pits, considered not only diversion layouts in which the tunnel was one component of a canal/tunnel/pipeline arrangement, but other layouts also where diversion was solely by tunnel. The possibility was considered of tunnel schemes which could also effect drainage of the pit slopes.

Three main tunnel layouts were examined:

- a pressure tunnel running under the pit through weak rocks and granular deposits (Layout A)
- a tunnel running between the pit and the eastern escarpment, also through weak rocks and surficials (Layout B)
- a tunnel through the eastern escarpment predominantly through stronger rocks (Layout C).

Evaluation of these three alternatives showed that because of the depth of surficials, potential pressure and inflows of ground water during excavation, and limitations of methods of tunnelling through both

surficials and weak claystones, Layouts A and B should not be considered further. Layout C merited detailed investigation; the summer field work program was oriented toward locating and proving tunnel alignments through the eastern escarpment.

Existing data was assessed, geological mapping, and a geophysical survey were carried out to determine the geological framework of the eastern escarpment. At the same time, current methods of tunnelling were studied to decide which would be the most appropriate methods of excavation for the types of ground anticipated. On this basis, a program of investigation was carried out including diamond core drilling, field testing and laboratory testing to enable the definition of geotechncial units, and hence the selection of alternative tunnel routes through the escarpment.

Five geotechnical units (G1 to G5) were established, and four possible tunnel alignments (T1 to T3A) were selected for detailed evaluation. Methods of excavation for the four alignments and potential problems were considered. Requirements for tunnel support and lining were compared, as well as schedules and unit costs for different excavation techniques.

Comparison of the routes resulted in the following cost estimates:

	$ M
T1	16.25
T2	18.07
T3	20.93
T3A	19.08

However, factors other than cost must be taken into consideration in the selection of a preferred alternative, namely: geological conditions and implied uncertainties, construction preferences (ease, simiplicity, etc.), and remoteness from the pit (safety under abandonment plans).

The conclusions of the study were that the tunnel alignment T3A is the preferred route for inclusion in the overall diversion studies (see Main Text). This route is shown on Figure 12. It would involve tunnelling predominantly in the weak claystones/siltstones and sandstones for most of the length, with stretches toward the north and south ends in highly brecciated or jointed, altered andesite. Both portals would be developed in glacial deposits, and a significant length of the tunnel at the downstream end would be in largely dry granular surficials. Excavation would be by an excavator shield (see Figure 10 and Table 4), with a precast segmental lining. No major problems are foreseen, but either further investigation is necessary or a suitable formulated contract would need to be let, taking into account the degree of geological uncertainty.

Golder Associates
CONSULTING GEOTECHNICAL AND MINING ENGINEERS

REPORT TO B.C. HYDRO ON THE HAT CREEK PROJECT GEOTECHNICAL AND HYDROGEOLOGICAL UPDATE, FALL 1982

CENTRAL BRITISH COLUMBIA

VOLUME I - MAIN TEXT

DISTRIBUTION

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3 copies - Golder Associates
Vancouver, British Columbia

December, 1982

822-1524

SUMMARY AND CONCLUSIONS

SCOPE OF WORK

This report contains the results of the geotechnical and ground water studies carried out by Golder Associates at Hat Creek during 1982.

The work comprised the following:

- Assessment of the geology on the east side of the pit in relation to the diversion tunnel investigation results.
- Assessment of the structural data obtained from previous drilling to establish a zonation of the east side of the pit.
- Reassessment of the geotechnical basis for the pit slope design.
- Assembly and reassessment of all the ground water data accumulated since 1978.
- Execution of a geophysical survey to investigate the depth of the surficial deposits in the northeast of the pit.
- Ground water exploration by drilling to assess the deep glacial deposits of the northeast buried channel.
- Reworking of the 1978 estimates of ground water inflow to the 2240 MW Pit and assessment of the inflow to the 800 MW Pit; dewatering designs.

GEOLOGY OF EAST SIDE OF PIT

Data acquired from the tunnel investigation to the east of the pit [Golder Associates, 1982(A)] has permitted a clearer understanding of the geology of the eastern escarpment, but has only assisted in the understanding of the geological relationship between those rocks and the Medicine Creek Formation to the west to a limited extent. However, the rock mass strength of the escarpment indicates that the rocks should not pose a hazard to the proposed 2240 MW Pit which would be excavated at

The report reiterates the factors upon which the geotechnical design of the slopes is based and recommends a careful flexible approach to excavation. Due attention must be given to the geology, material strength, ground water conditions and rate of excavation.

Analogies are drawn with the experience of the Panama Canal from the benefit of a visit to the slopes there.

GROUND WATER

The piezometric data accumulated over the period 1976-82 has been put onto computer file to facilitate future use. Piezometer hydrographs have been plotted and values for hydraulic conductivity recalculated where it is apparent that stabilization had not yet occurred. Revised piezometric contours have been drawn for bedrock and surficial deposits. Abnormally low piezometric levels in two piezometers close to the burn zone probably indicate negative pore pressures developed on unloading of the area by burning. The piezometric head distribution remains largely unchanged from 1978 but the heads are slightly lower in some cases.

An exploration program in the buried valley in the northeast of the pit area was carried out by geophysical survey and drilling. It was shown that the glacial deposits infilling that valley had hydraulic conductivities in the range of 1.0×10^{-7} to 9.0×10^{-7} m/sec. For this reason, screened wells were not installed for test pumping as planned.

Based on the re-evaluation of the hydrogeological parameters, bedrock inflows to the 2240 MW Pit in Year 35 are anticipated to be in the range of 1.7×10^{-1} to 1.25×10^{-5} m^3/sec; surficial inflows to the same pit would likely be approximately 5.7×10^{-3} m^3 /sec. Inflows from the surficials would be reduced from that calculated in 1978 due to the absence of seepage from the previously proposed diversion canal and the lower recorded permeability from the northeast area. A revised mine dewatering arrangement is presented.

Structural data acquired from previous drilling has been analyzed and an attempt has been made to zone the east side of the pit within the limitations of the data.

GEOTECHNICS

A re-appraisal has been made of some of the geotechncial aspects of the project which required further clarification. These included: rock strength, seismic analysis of the waste dumps, pit slope stability and a comparison with the Panama Canal slopes.

A complete re-analysis was carried out on all the triaxial tests performed by Golder Associates on the claystone/siltstone sequence. The trends indicated in the previous reports were demonstrated much more clearly. Two strength envelopes can be drawn: for the brecciated samples $c' = 0$ MPa, $\phi' = 16°$; for the structureless samples $c' = 0.38$ MPa, $\phi' = 20°$. When the proportion of these materials can be assessed in any particular slope within the pit, its stability can be computed more reliably than hitherto.

The stability of the Medicine Creek waste dump has already been analyzed under seismic loading using pseudo-static stability analyses; this report contains the results of similar studies on the Houth Meadows dump. The lowest static factor of safety using conservative assumptions is 2.08. A factor of safety of 1.0 is achieved with a horizontal earthquake acceleration of 0.05 g, assuming liquefaction of foundation silts. Such silts would need to be removed if shown to be present. Analyzing the dump for displacements by the Newmark method, using an acceleration as above, a downstream movement of 0.6 to 1.0 m could be expected. By comparison with the behaviour of El Infiernillo and La Vallita Dams in Mexico under loading imposed by a magnitude 7.6 event, the Houth Meadows retaining embankment should suffer acceptably small displacements for an event of that size.

An independent evaluation of Golder Associates' geotechnical work has been carried our by Professors P. Rowe of Manchester University and N. Morgenstern of the University of Alberta. Both have endorsed the approach taken, have largely agreed with the conclusions and have made recommendations for the future.

For the 800 MW Scheme, 35-year bedrock inflows are anticipated to be in the range of 3.2×10^{-2} to 2.4×10^{-6} m^3/sec and total surficial flows 3.4×10^{-3} m^3/sec. A mine dewatering plan is presented.

High transient inflows are likely, but would probably be of short duration. They would most likely be associated with faults or closely jointed zones which are difficult to predict.

FURTHER WORK

Most of the further work required for design would be carried out in the early phases of excavation when good exposures would be available. However, it has been recommended by Professor Rowe that detailed testing before design be carried out on large diameter samples; these could be obtained from adits or large diameter auger holes. When the project activities are resumed, it is recommended that consideration be given to this appraoch.

We thank you for the opportunity of carrying out these further studies on the Hat Creek Project. We have pleasure in submitting this final report.

G.E. Rawlings, P. Eng.

N.A. Skermer, P. Eng.

R.S. Guiton

GER/NAS/RSG/sek
822-1524B

4.3 "A" ZONE BULK SAMPLE PROGRAM

B.C. HYDRO

HAT CREEK PROJECT

MINING FIELD PROGRAM 1982

TRENCH D

MINING DEPARTMENT

Prepared by: Mining Department

CR36

January 1983

SUMMARY

This report outlines the field activities associated with the Trench D portion of the 1982 Mining Field Program at Hat Creek.

Contracts for overburden removal for Trench D were awarded in early May 1982 and work commenced on site on 26 May 1982. The entire trench site ground cover was grubbed and cleared and topsoil was scraped and stockpiled for future reclamation. A total of 120 448 bank cubic metres was excavated during the 5 weeks of overburden removal. This included 72 269 bank cubic metres of overburden and 48 179 bank cubic metres of waste coal.

The exposed coal measures were geophysically logged, channel sampled and mapped by Mining Department geologists. The individual beds were identified in terms of zones and subzones and detailed plans were formulated for excavating the bulk sample.

Coal mining commenced at the east end of the pit and progressed westward to the Medicine Creek clay at the top of the A-zone coal. A P&H 418 backhoe was used to cut a slot trench 11 m wide at the top, 2.5 m high and 10 m wide at the bottom. A 2 m x 2 m cut on the south side was excavated and sent to the crusher to form the bulk sample. Partings <2 m thick were deliberately left in the sample to comply with existing mine design criteria. The coal and parting material which was not used in the bulk sample was stored in separate piles, according to the subzone groupings developed in the mining plan. These stockpiles were compacted with a tractor-dozer to prevent spontaneous combustion.

The bulk sample material was crushed to -15 cm topsize in a portable jaw crusher. Each subzone grouping from the mine was crushed and sampled separately. A total of 772.6 t of crushed material was placed in one

common windrow pile. Comparison of analytical results from the channel samples and the bulk samples indicated that the overall bulk sample was representative of A-zone ROM coal. The composite sample pile was subsampled to produce the various bulk samples required for coal quality and coal preparation pilot scale tests.

Bulk samples were shipped offsite in late August to the following test facilities:

1. EPRI Coal Cleaning Test Facility in Homer City, Pa.

   - 10 t (50)drums (A-zone coal)
   - 150 t - 2 bottom hopper rail cars (A-zone coal)

2. KHD - Batac Jig Test Facility in Bochum, West Germany

   - 10 t (5[illegible]) drums (A-zone coal)

3. Hazemag, Union Town, Pa.

   - 1 t (5) drums (Medicine Creek clay)

4. H. Colijn, Monroevill, Pa. (material handling consultant)

   - 1 - (5) gallon pail of -1/4 inch - "A"-zone coal

At the time of this writing, only the Homer City tests had been performed. Laboratory tests were still in progress, but preliminary indications are that Hat Creek A-zone coal can be successfully washed without undue process problems in either the preparation plant circuitry or in the tailing dewatering equipment.

Environmental protection planning was conducted concurrently with the development of the study program. Topsoil was scraped from both the

trench proper and the waste disposal area and stockpiled for use in reclamation. Care was taken to provide suitable drainage control works in all disturbed areas. A dust study was undertaken to determine airborne dust concentrations at various distances from the excavation activities and to evaluate methods of control. Two leachate piles were established using a mixture of tills and silty clays in one and Medicine Creek claystone in the other.

Miscellaneous areas were scarified by rake and other areas were recontoured to lessen slopes prior to reseeding. Numerous test plots were created in order to demonstrate the ability to reclaim different types of waste materials under a variety of conditions.

THE UNIVERSITY OF
BRITISH COLUMBIA

Na DISTRIBUTION IN HAT CREEK COAL AND ITS EFFECT ON BOILER PERFORMANCE AND ASH-FUSION TEMPERATURE

FINAL REPORT

Professor A.C.D. Chaklader

DEPARTMENT OF
METALLURGICAL ENGINEERING

VANCOUVER, BRITISH COLUMBIA • CANADA

ABSTRACT

The ash-fusion temperature and the inorganic minerals present in fifty-five coal samples from Hat Creek have been determined. The samples were obtained from different drill holes and from different depths, covering almost the whole Hat Creek coal deposit and representing almost all coal sections.

The lowest initial ash fusion temperature (IT) encountered was in only one drill hole sample and ∿ 1150°C in a reducing atmosphere. About 10% of the samples tested have IT values between 1200 and 1300°C, and ∿ 14% between 1300 and 1400°C. The remaining samples have IT values above 1400°C. Because of the low concentration of alkalies (∿ 2% of $Na_2O + K_2O$), the ash-fusion temperature is primarily controlled by FeO, SiO_2 and Al_2O_3, and occasionally modified by CaO(+MgO). This is reflected in high values for the final melting temperature (FT values) even for the samples having lower IT values.

The dilution effect of coal on the quantitative determination and detection of inorganic minerals has been found to be very significant. In spite of this, the major concentration of minerals can be reasonably estimated by the XRD technique and major oxide constituents can be calculated from the x-ray analysis.

Large concentrations of bentonite (and/or illite) were encountered in a large number of drill holes, which may produce large amounts of fly-ash and also clinkers during combustion of this coal. However, this needs further study.

INSTITUTE FOR HUMAN PERFORMANCE
DEPARTMENT OF KINESIOLOGY
SIMON FRASER UNIVERSITY

STUDY OF THE NATURE AND BEHAVIOR OF

SODIUM IN HAT CREEK COAL

B.C.Hydro and Power Authority

(Thermal Division) Purchase Order No. 259832

Project Directors

Samia M.Fadl, Ph.D.,P.Eng.
Simon Fraser University,
Burnaby, B.C. V5A 1S6

December, 1982

Joffre M.Berry, Ph.D.,
Program Head, Chemical Sciences,
British Columbia Institute of Technology,
Burnaby, B.C. V5G 3H2

1.— SUMMARY

The total sodium content in fifty Hat Creek Coal samples was determined by using an acetic acid leaching technique followed by atomic absorption spectrophotometric measurements. A preliminary distribution of the variation of sodium along the subzones and along the strikes were investigated. The nature of the sodium in the coal "total", "active", and "volatile" were studied based on a concept previously investigated in other laboratories. The distribution of these types of sodium was provided from the samples received. The data indicate that the concentration of total sodium in Hat Creek coal is not uniform and ranged between 0.69 - 3.78% (Na_2O ash basis) in the samples tested. The values of total sodium as measured by the standard ASTM technique are lower than those obtained using the weak acid leaching procedure. This indicates a potential volatilization of sodium during ashing the samples. The results indicate that a high content of potentially volatile sodium is present in the coal samples (30 - 45%). This potentially volatile sodium is approximately 50% of the available weak acid soluble sodium "active sodium".

4.5 CLAYSTONE INVESTIGATION PROGRAM

HAZEMAG (Canada), LTD. LTÉE

1867 Yonge Street, Suite 60
Toronto, Ontario M4S 1Y
Tel.: (416) 481-307
Telex: 06-2379

November 17, 1982

B. C. Hydro
Box 12121 - 555 W. Hastings Street
Vancouver, B.C.
V6B 4T6

Attn: Mr. W. E. Meeks

Dear Sir:

On behalf of Hazemag Canada Inc. I must apologize for the long delay in forwarding the results of our pilot plant tests to you. A number of large on-going projects have occupied our staff and equipment for some time and this has delayed our report.

Enclosed please find the results of 7 crushing tests performed on November 1, 1982. Parameters such as feed size, rotor speed, gap settings and moisture content were varied and the results were compiled on page 3 and shown in graphical form on pages 4 - 6. Please note that pages 7 - 15 have not been enclosed because they only show individual test data which has been summarized on page 3.

Three major conclusions can be drawn from our testing:

1. This claystone and siltstone crushes easily in an impact crusher at low speeds and abrasive wear would not be a problem.

2. Hazemag projects the following product gradation if minus 48" feed were to be processed in one of our AP-P primary crushers:

100%	- 8"
95%	- 6"
70%	- 4"
55%	- 3"
40%	- 2"
22%	- 1"
13%	- ½"
8%	- ¼"
4%	- 1/8"

This is shown graphically on page 6.

3. We found no problems with buildup on the impact plates at 12% moisture. Test #4 was run at approximately 25% moisture and significant sticky buildup did occur on the second apron with lesser amounts appearing on the inlet slide and primary apron. This result was expected from installations of our crushers in clay processing plants around the world. Some reduction in buildup can be achieved by using heated aprons but this would not be feasible for Hat Creek where this machine would likely be portable. A more practical possibility is to blend rock with the clay so that it would sandblast sticky materials from the impact plates. We estimate sticking problems would occur at moisture levels above 12%.

As I suggested during our meeting in Calgary, Hazemag can supply equipment for crushing coal, limestone or gravel for Hat Creek as well as machines to handle the type of overburden we have just tested. We would be interested in discussing these other applications when this project proceeds.

We trust this information is of interest to you and we look forward to our future discussions on this subject.

Yours very truly,

HAZEMAG CANADA INC.

Randy Fridulin
Regional Sales Manager

Encl.

HAZEMAG-Prallmühle

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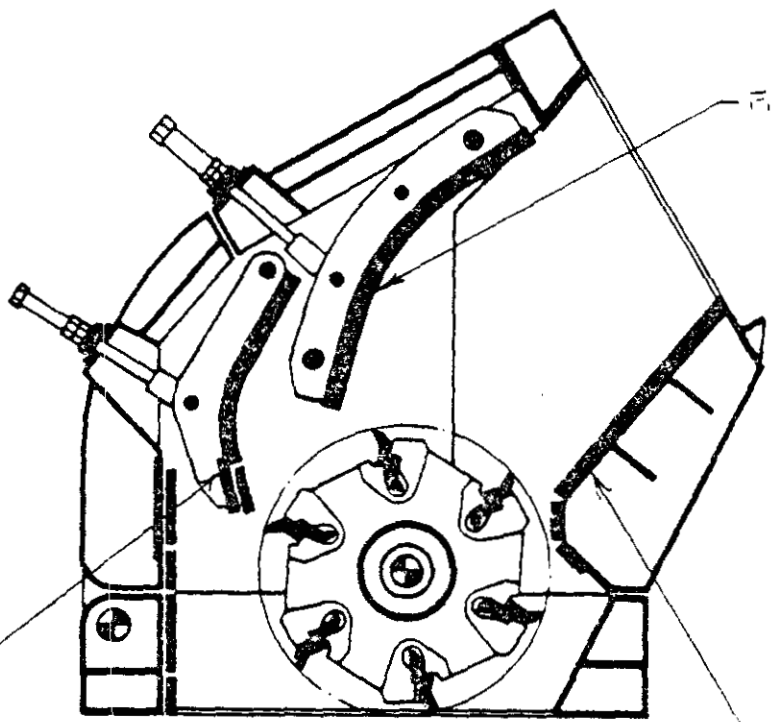

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