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MATERIALS HANDLING, SCREENING, CRUSHING, AND LOW GRADE COAL BENEFICIATION

By

SGB/PVT/DBN

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SECTION 1

INTRODUCTION

1.1 BACKGROUND

The preliminary engineering mining Feasibility Study for the No. 1 Deposit at Hat Creek was completed in October 1978. Simon-Carves of Canada Ltd. had undertaken the coal beneficiation section of this study. On consideration of the cost benefits, B.C. Hydro and Power Authority concluded that beneficiation should not be included in the Mining Scheme, and that the Power Plant should be designed to burn blended raw coal.

It was therefore proposed that quality control should be achieved by means of mine planning and operational control, together with large scale blending of the potentially very variable raw coal. To achieve the optimum product quality, it was found necessary to mine, but exclude from the supply to the Power Plant, a quantity of "Low Grade Coal." It was proposed that this material be stockpiled for possible future utilization.

The mining and Power Plant Schemes were subsequently evaluated by the Authority's Technical Review Board, who remitted certain items to the Authority for reconsideration during the summer of 1979. These included the possible incorporation of a "Low Grade Coal Beneficiation" facility within the Mine Mouth Materials Handling Scheme.

Simon-Carves, who had given preliminary consideration to this in March 1978, were engaged for this work.

1.2 SCOPE OF REPORT

It was necessary to ensure that any Low Grade Coal Beneficiation plant would be an integral part of the materials handling, screening and crushing facilities. The selection and layout of some equipment within the previous scheme was also subject to review by the Authority. Simon-Carves' scope of work was therefore widened to include assistance in aspects of this review. This enabled Simon-Carves knowledge of coal processing and handling to be of particular relevance.

This Report therefore considers the selection and design of the conveying, screening and crushing facilities for all mine products. The overall scheme now includes facilities for beneficiation by dry screening of the Low Grade Coal.

SECTION 1

INTRODUCTION

1.3 ACKNOWLEDGEMENTS

In addition to relevant sections of the July 1978 Mining Feasibility Report, and the Authority's September 1978 Composite Report "Appendix D - Coal Quality and Handling", Simon-Carves also had access to other documents which are acknowledged in Appendix VI - Bibliography.

This study was accomplished in a short time by close working contact and detailed discussions with the staff of the Authority's Mining Department.

SECTION 2

SUMMARY

The layout of the Truck Dump and Primary Crushing Stations in the Mine has been revised in principle to give greater operational flexibility. In particular, it will be practicable to utilize alternative crushing equipment to suit the variety of materials which are to be mined.

Each mine conveyor now has a designated normal duty. Following bulk density tests, it is recommended that all conveyors be increased to 1.37 ~~meters~~ (54") wide. 1400 mm (54 NOMINAL)

The potential beneficiation of Low Grade coals by means of dry screening, wet screening and washing has been further evaluated. It is concluded that wet methods will give formidable tailings disposal problems, but that a useful degree of beneficiation can be simply achieved by dry screening.

The layout of the screening and secondary crushing plant has been completely revised to provide beneficiation by dry screening of Low Grade coal. Also, duplicate conveyor lines from the plant will allow simultaneous transfer of lower grade coals to the blending system and by-passing of High Grade coals to the Power Plant.

Recommendations are given for further testwork related to the crushing characteristics of all the materials to be mined, this having been emphasized in the replies received from proprietary equipment manufacturers.

Equipment used in the preliminary scheme is of established designs in current commercial use. Attention is drawn to units being developed which may be more suited to the requirements.

The unique characteristics of the Hat Creek coals necessitate further testwork prior to the design of any Low Grade coal beneficiation facility. It should be noted that no samples have been obtained which have been proved representative of the bulk of this material.

SECTION 3

DESIGN REQUIREMENTS OF MATERIALS HANDLING, SCREENING & CRUSHING SYSTEMS

3.1 INTRODUCTION

This section of the report considers the various materials which will be produced in the mine, and the facilities required to deliver them to the appropriate utilization points.

Production data is taken from the Cominco-Monenco Joint Venture Mining Feasibility Report, Volume III, Mine Planning. Further understanding has been obtained of the proposed operations by discussion with B.C. Hydro Mining Engineers. However, the basic scheme proposed by C-MJV is unchanged. It would not be feasible to make major changes without access to the total study of the truck/shovel mining method.

This study is therefore limited to reviewing the selection and basic design of specified elements of the system:

Dump Pockets and R.O.M. Crushers
Width and Speed of R.O.M. Conveyors
General Arrangement of the Coal Preparation Area, with particular reference to the Low Grade Coal.

3.2 RUN-OF-MINE MATERIALS

This study has identified eight distinct run-of-mine materials which may require separate handling from the mine. Each of these materials may pose different handling problems in winter and summer conditions. Their characteristics may also be significantly different when mined from dewatered areas below the existing water table as compared with initial production in comparatively dry conditions. For this reason it is necessary that the handling system design can be modified as the mine develops.

3.2.1 Waste

The largest volume of run-of-mine materials will be waste supply described as a mixture of young shales with clay bands. This waste is therefore soft compared with that from most coal mining operations, and will break readily in crushing. The varying clay content will cause build-up of fine material in hoppers, chutes and within crushing equipment. The ability of bentonitic clay to absorb moisture means that this material will not be effectively dewatered by the mine draining operation.

SECTION 3

DESIGN REQUIREMENTS OF MATERIALS HANDLING, SCREENING & CRUSHING SYSTEMS

3.2 RUN-OF-MINE MATERIALS - cont.

3.2.2 Waste for Construction

Some of Some clay free waste which will need to be segrated for mine road, waste dump dam, and other construction requirements, comes particularly from areas of glacial till to be removed at an early phase of the mine. Some of this This material could therefore be trucked directly to the point of use rather than delivered through the main waste conveyor system. Large boulders which would require special crushing equipment may also be handled at lower cost by direct trucking from the mine.

3.2.3 Clay

An area of massive clay with a high water content has been identified in Medicine Creek. This will require purpose designed handling and crushing involving a minimum of chutes.

3.2.4 Normal Coal

The bulk of the run-of-mine coal is expected to contain varying proportions of soft shale and clay materials. When dry this material has been observed to crush and handle with ease. However, the large scale mining operation requiring dewatering of much of the coal strata means that it will have a significant surface moisture content. The design of the normal run-of-mine coal system must therefore be based on criteria for coals classed as difficult.

It can be anticipated that in the early stages of the mine development the proportion of material with a difficult handlability will be quite low, and therefore a program of progressive improvements to the handling system through the mine life is possible.

3.2.5 Petrified Wood in Normal Coal

Petrified wood has been identified as present in significant quantities in areas of the coal strata. Run-of-mine coal may therefore need to be selectively crushed to reject this material.

SECTION 3

DESIGN REQUIREMENTS OF MATERIALS
HANDLING, SCREENING & CRUSHING SYSTEMS

3.2 RUN-OF-MINE MATERIALS - cont.

3.2.6 High Clay Content Normal Coal

In some areas there are thick bands of clay in the coal strata which it would not be economic to separate by selective mining. Coal handling systems must therefore accept this material.

3.2.7 High Grade Coal

The D Zone will provide coal of lower sulphur content and higher calorific value. This may need to be segregated in the mine and conveyed separately to the Power Plant either to assist in achieving high power output despite mechanical problems, or to facilitate the lowering of sulphur dioxide emissions in adverse climatic conditions.

3.2.8 Low Grade Coal

Low Grade Coal will have to be segregated in the mine and separately handled to a beneficiation system if the required Normal Coal quality is to be maintained. This material is some 10% of total coal production over the mine life.

3.3 MINE CONVEYOR SYSTEMS

The various run-of-mine materials described in the previous section have been considered with respect to their production rates and system requirements to minimize stockpiling and effect segregation.

A minimum of three mine conveyors are required. These conveyors, with their particular feed and run-of-mine crusher system designs, should be dedicated to specific duties:-

3.3.1 Normal Coal Conveyor

This system would be in continuous operation handling coal production from all four coal zones (A,B,C and D). Rejection of petrified wood must therefore precede this conveyor. High clay content raw coal will also follow this route.

SECTION 3

DESIGN REQUIREMENTS OF MATERIALS HANDLING, SCREENING & CRUSHING SYSTEMS

3.3 MINE CONVEYOR SYSTEMS - cont.

3.3.2 Waste and Clay Conveyor

This conveyor route to have a minimum of transfer points of the simplest possible design : ie. no two-way transfer chutes and vertical drop feed from one conveyor to the next.

3.3.3 Low Grade Coal/Spare Conveyor

In addition to its primary duty, this conveyor would provide a standby for either normal coal or normal waste.

Consideration of the quantities of normal waste material to be removed, and the production pattern of low grade coal in certain periods (eg. years 4 to 11) leads to the recommendation that a fourth conveyor be installed at least from the upper level of the mine:-

3.3.4 Normal Waste Conveyor

This conveyor to take the bulk of dry waste from upper levels of the mine, thus giving more flexibility in the use of 3.3.2 and 3.3.3.

Each conveyor system is based on 3,000 cubic meters per hour, ie. up to 3,200 tonnes per hour of coal, 5,000 tonnes per hour of waste.

The position of the conveyors in the mine has not been altered. Thus the mine dump pocket system proposed by C-MJV can be retained. With the designated conveyor duties proposed above, the conveyor centre-lines are acceptable.

Measurements of the bulk density of coal and waste samples confirmed the swell factors suggested by Weirco. The mine conveyors recommended are therefore 1400mm wide (54 inches) operating at 4.5 meters/second. This width is also recommended within the Coal Preparation Area, with the speed reduced to 2.5 meters/second for the 1000 tonnes per hour conveyors feeding to screening equipment.

SECTION 3

DESIGN REQUIREMENTS OF MATERIALS
HANDLING, SCREENING & CRUSHING SYSTEMS

3.4 PRIMARY CRUSHING STATIONS

The selection of equipment and design of these stations must take account of the characteristics of the materials identified in Section 3.2. Crushing tests have been limited to the breaker drop tests conducted by Fawcett, and testwork by manufacturers of other specialist types of crushers is essential. Representative samples of as mined materials of the more difficult categories below water table level will not be available until the mine has been in operation for some years.

Preliminary design of the primary crushing systems should therefore allow for the substitution of alternative crushing systems. (Note that the C-MJV layout can be used only with the Siebra type).

Review of available crushing systems confirms that 1500 cubic meters/hour is a practical maximum for most manufacturers and the designs considered in this report are based on this throughput. Feed could therefore be received simultaneously from two dump stations to each conveyor.

Consideration of desirable maximum particle size together with wear and tear in subsequent handling, screening and secondary crushing operations,reduce the run-of-mine material to below 200mm. This would also facilitate rejection of more unwanted material, eg. petrified wood, than the 300mm previously used.

3.4.1 Dump Pockets

Each Dump Pocket to hold approximately three truckloads to permit smooth turnaround of mine trucks.

Due to the sticky clay problems we are recommending steeper slopes than normally encountered, and could not recommend the use of box shaped pockets (ie. where the fall of large lumps is broken by a static bed of material).

SECTION 3

DESIGN REQUIREMENTS OF MATERIALS HANDLING, SCREENING & CRUSHING SYSTEMS

3.4 PRIMARY CRUSHING STATIONS - cont.

3.4.1 Dump Pockets - cont.

Some crusher manufacturers claim to accept lumps of the maximum anticipated dimensions without a grid over the hopper. (For example, in Hazemag's System there is a "breaking access trap" for oversize lumps). We consider it is undesirable to operate with no top size restriction, and have retained the 600 x 600mm grid size from which gross oversize pieces will have to be removed, for example by front end loader.

(Consideration should be given from a personnel safety aspect to using a 450 x 450mm grid. Also, it should be noted that if this size were adopted it would be possible to convey from the dump pocket discharge to crushers situated directly over the appropriate mine conveyor. However, the 450 x 450mm grid could retain unacceptably large quantities of material for removal).

3.4.2 Run-of-mine Feeders

Vibrating feeders are not sufficiently powerful or robust for this duty. The variable speed apron feeder is most widely used. Most manufacturers of push-plate type feeders do not have large enough units available. This feeder has the disadvantage of losing height, whilst the apron feeder can elevate. However, Hazemag have a large capacity hydraulically operated feeder which is included as part of their System package.

3.4.3 Run-of-mine Screens

It is desireable to remove undersize to reduce the load on the crusher - particularly when sticky fines are present - and to avoid excessive breakage.

The Krupp Roller Screen is an integral part of the Siebra Crusher. This type of self-cleaning screen has a good reputation for operating on sticky feeds, and has the mechanical strength to accept large heavy lumps. The geared drive mechanism of the Krupp must be a high initial cost component.

SECTION 3

DESIGN REQUIREMENTS OF MATERIALS HANDLING, SCREENING & CRUSHING SYSTEMS

3.4 PRIMARY CRUSHING STATIONS - cont.

3.4.3 Run-of-mine Screens - cont.

The Pettibone Wobbler Screen appears to be a viable alternative. The "wobbler" screen blades should provide an enhanced cleaning action. The chain drive should be cheaper yet present few problems.

Generally, vibrating screens are not sufficiently robust for these duties, and jigging screens would be of large unit size. Such conventional screening machines also lose height compared with the horizontal roller screens. We have, however, included a Simplicity vibrating screen which is standard in the Hazemag System package.

3.4.4 Run-of-mine Breakers

3.4.4.1 Bradford Breaker

This is a voluminous machine best fed by conveyor with a preferred maximum lump size of 450mm.

Rejection of hard material such as petrified wood would be readily accomplished. It is likely, however, that there is also hard coal, ~~commonly described as "niggerheads"~~ which would be rejected. The drop shatter tests by Fawcett also suggest that some good coal may be lost.

The Bradford Breaker at Centralia has been observed to reject clay lumps from wet mining conditions similar to those anticipated from lower mine levels. Experience at Coal Valley, Alberta has included problems with build-up of wet clay fines on the outside of the drum and in the product collecting chutework. To clear these with quantities of water - as at Centralia - would be unacceptable unless all coal is to be washed.

SECTION 3

DESIGN REQUIREMENTS OF MATERIALS HANDLING, SCREENING & CRUSHING SYSTEMS

3.4 PRIMARY CRUSHING STATIONS - cont.

3.4.4 Run-of-mine Breakers - cont.

3.4.4.2 Krupp Siebra Crusher

This unit is successfully used in the Lignite Industry. It is able to reject the petrified wood. There may be problems with clay sticking in the crushing rollers. We endorse the reservations listed in correspondence to you by Krupp Industries. However, at this stage and subject to testwork, we propose this machine for Normal Coal, and particularly for the Normal Coal with Petrified Wood. It is necessary to have an alternative available should the wet clay be problematic.

3.4.4.3 Wing Crusher

The Humboldt Wing Crusher is also widely used in the Lignite Industry, but it could not accept hard waste, particularly Petrified Wood.

3.4.4.4 Impactors

The wide range of applications of this design suggests it will be able to accept all Hat Creek materials, except massive clay. Hazemag are the only manufacturer to offer units large enough for the run-of-mine duties. Different speeds are required for alternative duties, ie. higher speeds for Waste with clay, to give sufficient breaking and cleaning forces, lower speeds for coal without coal ? waste to minimize degradation.

Hazemag suggest tests should reveal a degree of selective crushing, which could achieve rejection of petrified wood if followed by screening.

The Hazemag design can be fitted with heated impact surfaces which would release wet clay. We propose these machines with provision for the oil heating system be added if and when required. It also may be easily opened for cleaning.

SECTION 3

DESIGN REQUIREMENTS OF MATERIALS
HANDLING, SCREENING & CRUSHING SYSTEMS

3.4 PRIMARY CRUSHING STATIONS - cont.

3.4.4 Run-of-mine Breakers - cont.

3.4.4.5 Impactors with Moving Breaker Plates

Machines of this type are in wide use with sticky materials. The Jeffrey Mud Hog has the advantage of reversible feed/breaker plates, and has been used in clay breaking as well as a variety of sticky coal and waste applications. Pennsylvania Crusher's Non-clog Hammermill also has an optional moving back-plate. With both of these machines, the breaker plate helps to feed the material into the impactor path. The Bulldog Non-clog Impactor type Hammermill appears to offer the best layout, however, since the breaker plate is near vertical, and the feed drops vertically onto the impactor as compared with the approximately 45^{o} feed of the Jeffrey and Pennsylvania machines. Bulldog's breaker plate may be inched away from the impactor for cleaning the machine, and it also has an optional moving back-up plate.

We are therefore, recommending this Bulldog machine for the Clay material. In the final analysis, it may be found that this machine is equally acceptable for general use, but at this stage we are recommending the Hazemag machine as detailed above.

3.4.4.6 Clay Feeder/Shredders

J.C. Steele (and others) manufacture a clay feeder in which a set of screws at the base extrude clay and deliver in a shredded form. These units have a low capacity - say 100 tonnes per hour and are designed for the clay industry. The major restriction to use of these machines is that they may be blocked up or even damaged by stones. We cannot therefore recommend these units for the clay waste.

SECTION 3

DESIGN REQUIREMENTS OF MATERIALS HANDLING, SCREENING & CRUSHING SYSTEMS

3.4 PRIMARY CRUSHING STATIONS - cont.

3.4.5 General Design

We recommend that the Run-of-mine Breaker stations be designed for location on the side of benches on either side of the mine conveyor system. Product conveyors would deliver to the mine conveyors with the facility by means of change-over chutes to deliver to either of a pair of mine conveyors. Thus, for example, a given system could deliver to the Low Grade Conveyor or Waste Conveyor. This will reduce the number of Dump Pockets required in the mine.

The other advantage of this layout is ease of access for maintenance of the feeders, screens and crushers, and the possibility of changing the type of crusher at a given point if changes in duty so requires.

3.5 COAL SCREENING AND SECONDARY CRUSHING

3.5.1 Introduction

The 200mm x 0 raw coal has to be crushed to below 50mm for delivery to the Power Plant. To reduce load on the crushers, and to minimize breakage, it is desirable to screen out the undersize at 50mm prior to crushing. The low grade coal may also be partially beneficiated by screening at say 13mm and rejecting the fines to waste.

This section reviews the dry screening and crushing units which may be applicable for these duties.

Prior to screening and crushing, hoppers are proposed for the following reasons:

- to give a more even feed to the units
- to permit emptying of the mine conveyors in the event of product conveyors, crushers or screens shutting down
- to divide the feed between modules so as to reduce size segregation and maintain efficiency.

It should be noted that a degree of mixing also takes place which promotes blending

SECTION 3

DESIGN REQUIREMENTS OF MATERIALS HANDLING, SCREENING & CRUSHING SYSTEMS

3.5 COAL SCREENING AND SECONDARY CRUSHING - cont.

3.5.2 Coal Screening

In selecting machines for these duties, we have been conscious of the need to base design on proven equipment at this stage. Developments in this field are also reviewed.

3.5.2.1 Conventional Screens

There should be no problems in using heavy duty 50mm x 50mm woven wire for removing undersize prior to the crushers. Partial blinding of the screen surfaces may occur when the wet clay content is high, but the presence of 200mm particles will keep this to an acceptable level. A safety factor has been used in determining the crusher capacity. The tonnages to be handled are within the capacity of conventional screens. There are many manufacturers : Allis-Chalmers Ripl-flo is widely accepted. The largest unit size is 8 ft. wide x 20 ft. long.

Consideration was given to the larger units now available, eg. the Siebtechnik Banana Screen. This would reduce the number of units, but more extensive chutework to collect product and feed crushers is required. This also reduces the flexibility which can be achieved by a modular design.

Woven wire or similar decks would not be suitable for screening at 13mm due to blinding when the feed is sticky.

3.5.2.2 Heated Deck Screens

Electrically heated decks have been used on moist coal feeds to permit more efficient dry screening in the 15 to 5mm size range. Maintenance may be high, particularly resulting from accidental damage.

3.5.2.3 Rod Deck Screens

Screen decks consisting of rods free to turn and vibrate within oversize mounting apertures are widely used in the 20 to 8mm size range in Europe. They give acceptably efficient dry fines removal, and are low in maintenance cost due to being robust.

SECTION 3

DESIGN REQUIREMENTS OF MATERIALS HANDLING, SCREENING & CRUSHING SYSTEMS

3.5 COAL SCREENING AND SECONDARY CRUSHING - cont.

3.5.2 Coal Screening - cont.

3.5.2.3 Rod Deck Screens - cont.

One problem is that they are very noisy in operation, and the screening section of the plant should be isolated from continuous operator access.

3.5.2.4 Probability Screens

Vibrating screens using a series of oversize decks which give effective fines removal by virtue of the chances of passing nearsize particles forward to overflow have found only limited application.

The National Coal Board (U.K.) has recently developed a rotating probability screen which is said to give good separations in the 12 to 4mm range. The "deck" is a rotating spoked wheel : increasing the wheel speed reduces the size of particle which passes through to undersize product. Performance data has not been made available.

These machines are currently of low unit capacity, typically 100 tonnes per hour, and a complexity of plant thus makes these units less attractive in total scheme cost.

Which is recommended?

3.5.2.5 Disc Screens

Radmark Engineering have recently developed a version of their disc screen for sizing in the 25 to 10mm range. Simon-Carves assisted with test evaluation, and a high throughput per unit area was obtained. This unit is to be further tested alongside probability screens in the U.K. and may be worth re-evaluation for the Hat Creek project at a later date.

3.5.3 Crushing

There are a wide variety of crushers available for reducing 200 x 50mm coal to below 50mm of similar design to the units described earlier. We have selected the Hazemag Impactor with optional heated breaker plates as the best machine for the sticky feed conditions, with the Jeffrey Mud-Hog a close second choice.

SECTION 4

BENEFICIATION OF LOW GRADE COAL BY WET PROCESSING

4.1 INTRODUCTION

Representative areas of coal which have been designated as Low Grade have not been sampled and tested due to their location. There are two situations which may give rise to this categorization:

- admixture of reasonably good coal with a higher than normal proportion of free shale and clay. This might be found for example as shaling out of the coal measures at the fringes of the deposit. Such raw coal would have a relatively good beneficiation potential : ie. cleaning would give a product yield, albiet small, of relatively high calorific value.
- raw coal with an even higher "impregnation" of clay in the particle fissures. This material would have a very poor beneficiation potential.

In the absence of any washability data of such raw coals, this section is concerned with projecting the data obtained for the "Normal" Hat Creek raw coal. These projections show in fact the latter of the above alternatives.

Therefore, washing the Low Grade coals would result in a product of low quality, despite the removal in the washing process of proportionately large quantities of clay as tailings.

A sub-sample of the August 1979 Trench A Low Grade material was subjected to wet screening and gives some confirmation of this, but no definite case for wet processing of the low grade coal can be made until representative samples have been obtained.

4.2 BENEFICIATION BY DESLIMING

Since the fines, say -28 mesh, are significantly higher in ash content than the coarse material, desliming the raw coal may give significant cleaning. Table 4-1 shows values which have been projected from the wet screening results obtained for the 1977 Samples X and Y, the CANMET screening tests, and the 1979 Low Grade Coal Sample.

TABLE 4-1 : BENEFICIATION OF LOW GRADE COAL BY DESLIMING

CV BTU/lb	ASH	Product = Screen O/Flow @ 75% Yield		Reject = Screen U/Flow @ 25% Yield		BTU Yield %	Degree of Beneficiation
		CV,BTU/lb	Ash %	CV,BTU/lb	Ash %		
2000	73.00	2440	70.00	679	82.00	91.5	1.27
2500	69.59	3057	65.80	832	80.96	91.7	1.29
3000	66.19	3644	61.80	1066	79.36	91.1	1.30
3500	62.78	4224	57.85	1329	77.57	90.5	1.31
4000	59.38	4789	54.00	1630	75.52	89.8	1.31
4500	55.97	5317	50.40	2047	72.68	88.6	1.31
5000	52.56	5846	46.80	2464	69.84	87.7	1.31
5500	49.16	6367	43.25	2897	66.89	86.8	1.32
6000	45.75	6880	39.75	3358	63.75	86.00	1.32

SECTION 4

BENEFICIATION OF LOW GRADE COAL BY WET PROCESSING

4.2 BENEFICIATION BY DESLIMING

Desliming does offer a relatively useful degree of cleaning for the lower plant costs involved and moderate loss of heating value for rejects.

All of these rejects must be considered as tailings rather than a solid waste discard. Tailings dewatering and disposal has been considered in the main report on Coal Beneficiation, and the conclusion that this will present formidable problems applies equally in this case. It is relevant to suggest that the recommended pilot plant work should commence with a simple desliming operation on Low Grade coal providing tailings for investigation. Once this problem has been resolved, circuit refinements to give a degree of washing may then be evaluated.

4.3 BENEFICIATION BY WASHING

No Washability Data has been obtained for the Low Grade coals. Therefore, it is necessary to see how available data shows trends which may be projected into this quality range.

Inspection of the Washability Data shows two general trends.

a) Finer Sizes are dirtier than coarser sizes.

b) For a given size fraction the higher ash of the poorer coals is due to a lower proportion of low gravity (low ash) coal/higher proportion of middlings and not to an increase in the high gravity (high ash) clay/shale partings material. (Note that this is evidence that we are concerned with a trend in coal quality and not a trend in admixture of even minute partings with relatively good coal. If the latter were the case, we should, with appropriate crushing, have a coal with a relatively good beneficiation potential. Also, note that the washability data in the CANMET Wash Test shows no liberation by crushing).

SECTION 4

BENEFICIATION OF LOW GRADE COAL BY WET PROCESSING

4.3 BENEFICIATION BY WASHING - cont.

4.3.1 Plant Requirements for Washing

The two-stage Water-Only Cyclone System (eg. EMR Canmet) may be considered for washing the raw low grade coal crushed to 40mm. The main disadvantage of this system is that the multitude of cyclone operations: feed classifying, first washing, second washing, and product thickening requires large volumes of water in circulation.

Operating costs for pumping are thus high and the several passes with circulating water will give a high tailings problem as found in the CSMT and EMR Test Washes and the Wet Attrition Tests. Large numbers of cyclones are required due to their relatively limited rejects capacity (25 to 30% of feed).

An alternative form of autogenous medium cyclone is available - the Simdex. The Simdex system was specifically developed for re-washing the rejects from inefficient plants or re-processing mine waste dumps. The Simdex uses the minus 28 mesh fine shale present to form a thick shale suspension in water which then acts in the cyclone as a dense medium for the 40mm x 28 mesh material. Since it was designed for waste coal treatment a Simdex Cyclone has some three times the rejects capacity of similar sized magnetite medium cyclone or water-only cyclone, and simpler liquids circuit.

The process does have disadvantages. Its efficiency is similar to two-stage water-only cyclones, and thus much lower than conventional magnetite medium cyclones. The separation gravities attainable depend on the characteristics of the minus 28 mesh shale particles, and it is probable that the clay content of the Hat Creek coal would be too high.

The Hirst Fine Coal Washer developed by the NCB (UK) has been used for re-washing mine waste piles as well as 10mm x 28 mesh fine coal. Due to the low water requirements, this unit would also warrant consideration.

SECTION 4

BENEFICIATION OF LOW GRADE COAL BY WET PROCESSING

4.3 BENEFICIATION BY WASHING - cont.

4.3.1 Plant Requirements for Washing - cont.

The modular Coal Washery as presented in the Coal Beneficiation Report, with modifications to the fines circuit, and extensive tailings facilities, could also be used. This would, however, be a very expensive plant for the low recovery of coal obtained. From that study, an approximate cost estimate suggests a capital investment of $12 million, and an operating cost of $2.50 per ton of feed. (This does not include the cost of a dewatered tailings disposal area). This would give a product cost of $6.50 per ton.

It can be concluded that a washing scheme is unlikely to recover useful coal at a cost comparable with mining the equivalent tonnage of additional Normal coal. Although it would be worthwhile investigating the performance of simpler process schemes designed specifically for this Low Grade material, the fact that the bulk of the cost is related to tailings dewatering and disposal means that an economically sound proposal is improbable.

4.3.2 Projected Washing Results

As the fines content increases and becomes dirtier the potential coal recovery from the finer sizes is very low. Therefore, it is not necessary to consider any washing of the minus 28 mesh material.

In Table 4-2 below it can be observed that the "yield error" (Theoretical Yield - Actual Yield) is high due to the difficult washability characteristics. Projecting results for the Low Grade coal therefore gives a very poor return for the cost of washing.

Similarly the reconstituted data from the CANMET Wash Test shows, for the 3/8" x 28 mesh size fraction a theoretical yield of 86.0% at 17.3% ash, but an actual yield of 75.6% from the 24.2% ash raw coal.

Table 4-3 shows values projected for the Low Grade coals in the 2000 to 5000 BTU/lb range.

SECTION 4

BENEFICIATION OF LOW GRADE COALS BY WET PROCESSING

TABLE 4-2 : BENEFICIATION POTENTIAL OF 1/4" x 28 MESH COALS - SEPARATION IN TWO-STAGE WATER CYCLONES

SAMPLE	% ASH OF RAW COAL		CLEAN COAL, ¼" x 28 MESH		
				% YIELD	
	4" x 0	¼" x 28M	% Ash	Theoretical	Actual
Z	26.9	28.9	21.6	82.0	62.4
C	29.1	27.2	16.9	78.5	65.2
B	36.3	34.3	25.3	77.2	65.1
X + Y	42.9	37.9	25.5	77.3	65.4
A	57.2	48.8	37.9	77.7	65.3

TABLE 4-3 : BENEFICIATION OF LOW GRADE COAL BY TOTAL WASHING

RAW COAL		CLEAN COAL PRODUCT			REJECTS INCLUDING TAILINGS		BTU Yield %	Degree of Beneficiation
CV BTU/lb	ASH % d.b.	YIELD Wt %	ASH % d.b.	CV BTU/lb	ASH % d.b.	CV BTU/lb		
2000	73.00	42.0	63.6	3380	80.1	958	71.0	1.95
2500	69.59	43.2	56.7	4392	79.6	1031	75.7	2.15
3000	66.19	44.4	50.8	52.58	78.6	1178	77.8	2.28
3500	62.78	45.6	45.2	6080	77.5	1339	79.2	2.40
4000	59.38	46.8	40.1	6829	76.3	1516	79.8	2.51
4500	55.97	48.0	35.7	7474	74.5	1780	79.7	2.60
5000	52.56	49.2	31.6	8076	73.0	2000	79.5	2.68

NOTE: These results do not include allowance for the "yield error" of the washing processes. Based on the probable use of a water-only washing cyclone system this would involve a reduction of about 10% in the yield, eg. for a 3,000 BTU/lb raw coal the actual yield would be 40.0% by weight, the BTU yield 69.8%.

SECTION 5

BENEFICIATION OF LOW GRADE COAL BY DRY SCREENING

5.1 INTRODUCTION

Our March 1978 Interim Report considered various sets of washability data from samples B, Y, X and A. Ash content versus size consist was plotted for each of these samples. A similar geometric trend was observed and further curves were projected to general relations for coals of 4500, 3700 and 3000 BTU/lb.

Additional data was available for this study which included the CANMET Test data, an independent sample taken in 1977, and the two new samples of Low Grade Coal taken in June/July 1979. This additional data was plotted using the same parameters as previous study work. The X and Y samples' data was combined in a 50/50 ratio and the composite data set was treated as a single set of data. Data from Sample C was also considered in this study.

5.2 THEORETICAL BENEFICIATION

Table 5-1 shows the theoretical results of dry screening various coals ranging in calorific value from 2000 BTU/lb to 6000 BTU/lb in increments of 500 BTU/lb. The corresponding ash of each coal quality was calculated using the revised ash/calorific value correlation equation.

It was assumed that the size of classification would be chosen such that 50% of the feed would report to overflow and a like amount to underflow. The average ash differential for a 50% classification is 6.84% (See Appendix III). Therefore, the screen overflow ash will be 6.84% cleaner than the feed ash. Similarly, the screen underflow ash will be 6.84% dirtier than the feed ash.

These theoretical ashes were applied to each raw coal quality and the corresponding calorific values were calculated using the given calorific value/ash correlation equation.

TABLE 5-1 : BENEFICIATION BY SCREENING OF LOW GRADE COALS (THEORETICAL)

RAW COAL		PRODUCT = SCREEN O/FLOW @ 50% YIELD		REJECT = SCREEN U/FLOW @ 50% YIELD		DEGREE OF BENEFICIATION	% BTU RECOVERY
CV BTU/lb	ASH % d.b.	CV BTU/lb	ASH % d.b.	CV BTU/lb	ASH % d.b.		
2000	73.00	3004	66.16	996	79.84	1.66	75.10
2500	69.59	3504	62.75	1496	76.43	1.55	70.10
3000	66.19	4004	59.35	1996	73.03	1.49	66.73
3500	62.78	4504	55.94	2496	69.62	1.44	64.34
4000	59.38	5004	52.54	2996	66.22	1.41	62.55
4500	55.97	5504	49.13	3496	62.81	1.39	61.16
5000	52.56	6004	45.72	3996	59.40	1.38	60.04
5500	49.16	6504	42.32	4496	56.00	1.37	59.13
6000	45.75	7004	38.91	4996	52.59	1.37	58.37

SECTION 5

BENEFICIATION OF LOW GRADE COAL BY DRY SCREENING

5.3 PREDICTED BENEFICIATION

Note that the above exercise did not consider the effects of screening inefficiency. Various data was collected regarding the partition factors applicable to dry screening operations as accumulated over the years. After considerable assessment and collation of this information a series of partition factors was calculated. These factors were then applied to the anticipated size consist of the feed.

The partition factors for the screening operation were applied against the anticipated size consist (see Appendix III) to determine the distribution of material in the screening operation.

The screen overflow and underflow qualities were predicted by applying the overflow and underflow quantities against the ash distribution. The ash distribution used was the same as that for the theoretical predictions. Table 5-2 below shows the predicted screen overflow and underflow ash and calorific value for various coals ranging in quality from 2000 BTU/lb to 6000 BTU/lb in 500 BTU/lb increments.

To further illustrate the beneficiation potential shown in Table 5-2, using dry screening consider the following example. Consider the case of a feed of 400 tonnes corresponding to the top four rows of Table 5-2, viz 25% @ 2000 BTU/lb, 25% @ 2500 BTU/lb etc. Assume that the quality of the product is equally distributed throughout.

If no screening were applied, the yield would be 400 tonnes at 3000 BTU/lb ie. the average calorific value of the feed.

If a manual "Cut-off" of 3000 BTU/lb was applied to this feed, 50% would be rejected viz 2000 BTU/lb and 2500 BTU/lb, as being below grade. Therefore the yield would be 200 tonnes at 3500 BTU/lb ie. the average calorific value of the acceptable quality product.

If dry screening were employed with only the screen overflow monitored by a Bulk Density Meter, the yield would be 247.6 tonnes at 3461 BTU/lb.

If dry screening were employed with Bulk Density Meters measuring ash of both the screen overflow and underflow products, the "cut-off" would be applied to each of said products simultaneously. With the overflow meter set to "cut-off" at 3000 BTU/lb, the product yield would be 179 tonnes at 3740 BTU/lb. Similarly, with the underflow meter set at 2540 BTU/lb, the yield would be 68.6 tonnes at 2896 BTU/lb. Together this would represent a yield of 247.6 tonnes at 3506 BTU/lb.

TABLE 5-2 : BENEFICIATION BY SCREENING OF LOW GRADE COALS PREDICTED FOR 20MM APERTURE

RAW COAL		PRODUCT = SCREEN O/FLOW @ 61.9% YIELD		REJECT = SCREEN U/FLOW @ 38.1% YIELD		DEGREE OF BENEFICIATION	% BTU RECOVERY
CV BTU/lb	ASH % d.b.	CV BTU/lb	ASH % d.b.	CV BTU/lb	ASH % d.b.		
2000	73.00	2461	69.86	1251	78.10	1.29	76.17
2500	69.59	2961	66.45	1751	74.69	1.24	73.31
3000	66.19	3461	63.05	2251	71.29	1.21	71.41
3500	62.78	3961	59.64	2751	67.88	1.19	70.05
4000	59.38	4461	56.24	3251	64.48	1.18	69.03
4500	55.97	4961	52.83	3751	61.07	1.17	68.24
5000	52.56	5461	49.42	4251	57.66	1.16	67.61
5500	49.16	5961	46.02	4751	54.26	1.16	67.09
6000	45.75	6461	42.61	5251	50.85	1.16	66.66

SECTION 5

BENEFICIATION OF LOW GRADE COAL BY DRY SCREENING

5.3 PREDUCTED BENEFICIATION - cont.

This clearly illustrates the advantage of beneficiation by dry screening in conjunction with Bulk Density Meters monitoring products. The above calculations assume that the manual "In-pit" section of the Normal/Low Grade and Low Grade/Waste cut-offs at 4000 and 2000 BTU/lb are effected with 100% accuracy. In practice, this would present a formidable operating problem.

The overall advantage of using the Bulk Density Meters illustrated above will be magnified several times when practical fluctuations in this In-pit selection are taken into account. In fact the only result which could be applied with reasonable confidence is the use of Bulk Density Meters monitoring both screening products.

In practice all material for example between 5000 BTU/lb and waste observed to contain some coal could be directed to the Low Grade Coal circuit for automatic optimization of recovery. This will greatly ease problems of mining system control.

The Bulk Density Ash Meters will need to be monitored and adjusted regularly to take account of variations in material characteristics. If the Normal coal is directed via the No. 1 Product Conveyors to the Blending Stockpile, and the No. 2 Product Conveyors are used only for the selected Low Grade coal product, the No. 2 Continuous Ash Meter will provide this monitoring facility.

5.4 PLANT REQUIREMENTS

The equipment requirements for screening and crushing have already been considered in Section 3.

A proposed scheme has been outlined based on these findings, and integrated into the Normal Coal handling, screening and crushing scheme. This is described in Section 6.

SECTION 6

DESIGN AND COST OF SCHEME

6.1 BASIS OF DESIGN

This scheme has been designed to provide capacity for the removal of 9000 m^3/hr. of material from the mine. Bulk density of the material to be removed ranges from 25kg/m^3 for coal to 50kg/m^3 for waste. Material to be removed will fall within this range. The scheme has provided for 1.37m wide conveyors running at 4.5m sec. to handle this capacity.

The original study called for three conveyors plus a future standby conveyor to perform the above described duty. These conveyors were to be completely interchangeable, that is, able to handle coal, waste, or a combination of both. However, the revised scheme, in order to maximize the availability and suitability of the conveying systems, has individual conveying systems for individual conveying duties.

The separation of the conveying systems by the products being carried has not been at expense of operating flexibility. The proposed conveying systems fall into two discrete categories, namely coal and waste. The coal conveyor out of the mine will handle coal only. A second conveyor will handle waste and clay only. A third conveyor will provide back-up waste capacity for the second conveyor but without provision for handling clay. The fourth conveyor will be capable of being a standby coal conveyor and standby waste conveyor in addition to being the low grade coal conveyor.

All conveyors are capable of transporting 3000 m^3/hr. This corresponds to 5000 tonnes/hour of waste and 3200 tonnes/hour of coal.

The coal handling system at the mine mouth has been designed for two grades of coal, namely normal coal and low-grade coal. The former system has been designed for 3000 tonnes/hour and incorporates four streams each capable of 1000 tonnes/hour. The low-grade screening and handling system is designed for 1000 tonnes/hour and consists of two streams each capable of 500 tonnes/hour.

The normal coal screening and crushing with four modules rated at 1000 tonnes/hour each is designed to crush 350 tonnes/hour per stream. The anticipated size analysis predicts that only 200 tonnes/hour is required, and therefore a coarser size analysis could be catered for.

SECTION 6

DESIGN AND COST OF SCHEME

6.1 BASIS OF DESIGN - cont.

The in-pit primary crushing systems have been designed for the individual materials. The normal coal truck dump station will employ a 600mm square grizzly above the 300 tonne capacity surge hopper. Crushing will be attained using a Siebra type crusher with capability for selective crushing.

The waste and low grade coal crushing systems employing a similar grizzly will crush using an Impact type crusher.

The 600mm square grizzlies on the truck dump hoppers will limit the maximum particle size to any specific crusher to 600mm x 600mm x 1200mm.

6.2 DESCRIPTION OF SELECTED SCHEME

This description should be read in conjunction with drawing F1490-01.

6.2.1 Normal Coal

Normal coal will be delivered to one of the normal coal truck dump stations and deposited in the surge hopper. Reclaim from said hopper will be by apron feeder discharging onto a roller screen working in conjunction with a Siebra type crusher. The roller screen will effect a size classification allowing smaller particles to pass through the rollers. Larger particles will be reduced in size by the overhead crushing mechanism. This mechanism will be designed to allow large pieces of uncrushable material such as petrified wood to pass under itself by lifting up. Therefore these large pieces of hard material will be discharged onto a conveyor for transport by truck.

The coal, either passing freely through the roller screen or reduced and forced through, will be collected on a transfer conveyor for delivery to the Normal Coal Conveyor. This conveyor will transport the normal coal from the mine and deliver to the Mine Conveyors Drive and Transfer House. From this point the coal will be transferred onto a second Normal Coal Conveyor for delivery to the Normal Coal Surge Bins. A rotating chute will distribute the coal feed equally into four bins.

SECTION 6

DESIGN AND COST OF SCHEME

6.2 DESCRIPTION OF SELECTED SCHEME - cont.

6.2.1 Normal Coal - cont.

Reclaim from each of the above four bins will be by apron feeder. Each feeder will discharge onto a conveyor delivering to the Screening and Crushing House. The coal will be discharged from each delivery conveyor onto a two-deck inclined vibrating screen. The top decks of these four screens will be fitted with 50mm square woven wire surfaces to effect size classification at 50mm nominal. The lower deck will be fitted with mild steel plate and function as a carrying deck.

Screen overflow will be discharged into an impact type crusher for reduction to minus 50mm. Screen underflow will be carried forward to blend with the crusher product. The minus 50mm normal coal will gravitate into a bifurcated chute for diversion to either the No. 1 or No. 2 Products Conveyors.

NO ASH METER

The No. 1 and No. 2 Products Conveyors will run parallel to the Transfer House where the coal will be transferred to a second parallel pair of conveyors. These second No. 1 and No. 2 Products Conveyors will deliver the coal to the Sampling House. A further transfer of the coal onto a third pair of Products Conveyors will occur in this house. These conveyors will deliver the coal to the Blending Piles Feed Conveyor or the Reclaim and Bypass Conveyor.

6.2.2 Low Grade Coal

Low grade coal will be delivered to one of the low grade coal/waste truck dump stations. These truck dump stations will also be capable of accepting waste material or coal. The truck dump hopper will be fitted with a grizzly having 600mm square openings.

Material in the hopper will be reclaimed by a reciprocating push feeder and discharged onto a cascading vibrating grizzly having 200mm square openings. The grizzly overflow will be discharged into an impact type crusher for size reduction to minus 200mm. Grizzly underflow together with the crusher product will gravitate onto a transfer conveyor for transport to either the standby waste conveyor or the low grade coal conveyor. A bifurcated chute will divert the material to either conveyor depending on quality.

SECTION 6

DESIGN AND COST OF SCHEME

6.2 DESCRIPTION OF SELECTED SCHEME - cont.

6.2.2 Low Grade Coal - cont.

Low grade coal carried on the Low Grade Coal Conveyor will be delivered to the Drive and Transfer House. The option will exist at this point to either divert the feed product to the normal coal system should said product be normal coal or to transfer onto the Low Grade Coal Conveyor for delivery to the Low Grade Coal Bins. Should the former option be applicable, the coal would be passed onto a Normal Coal Bypass Conveyor for transport to the Normal Coal Conveyor for delivery to the top of the Normal Coal Bins.

Low grade coal will be discharged into the Low Grade Coal Bin by means of a reciprocating chute arrangement to ensure an equal distribution to each of the two bins. Reclaim of low grade coal from each bin bottom will be by apron feeder. Each apron feeder will feed onto a low grade coal conveyor delivering to the Screen and Crush House for Low Grade Coal. Each conveyor will then discharge its product onto an inclined three deck vibrating screen. The top deck will be fitted with a 50mm square opening woven wire deck while the middle deck will be fitted with a rod deck having 13mm spacings. The bottom deck will be blanked off with mild steel plate and perform as a carrying deck.

The plus 50mm oversized material carried on the top deck will be discharged into an impact type crusher for reduction to minus 50mm. Material sized 50 x 13mm will pass via a chute to join the crusher product. A portion of this product will be directed into a Bulk Density Meter for ash monitoring. The ash value will determine which conveyor the plus 13mm low grade coal will be discharged onto. Should a low ash reading indicate the plus 13mm function as being acceptable boiler fuel, said fraction would gravitate onto the No. 2 Product Conveyor. Conversely, a high ash reading would cause the flop gate in the bifurcated chute to automatically divert the plus 13mm coal onto the No. 1 Rejects Conveyor.

The minus 13mm low grade coal carried on the lower deck will be similarly sampled on a Bulk Density Meter to determine ash. A bifurcated chute and flop gate will divert this product to either the No. 1 Rejects Conveyor or the No. 2 Products Conveyor depending on the measured ash. The routing of the latter conveyor has been described in Section 6.2.1.

SECTION 6

DESIGN AND COST OF SCHEME

6.2 DESCRIPTION OF SELECTED SCHEME - cont.

6.2.2 Low Grade Coal - cont.

The No. 1 Rejects Conveyor will terminate at the No.1 Rejects Conveyor Transfer House where the product will be discharged onto the No. 2 Rejects Conveyor. This conveyor will deliver to the No. 2 Rejects Conveyor Transfer House where the product will be fed into a bifurcated chute. The position of this chute will determine which waste conveyor will carry the product to the Houth Meadows Mine Waste Area.

6.2.3 Waste/Clay

The truck dump stations for the waste materials will be identical to those described in the previous section for low grade coal. However, large masses of homogenous clay will be kept separate and not dumped into the truck dump hoppers. Instead, this material will be dumped onto the ground adjacent to a clay reduction station. Location of these stations will be flexible however, preferable locations will be above the main Mine Waste/Clay Conveyor.

The clay will be removed from the ground by front end loader and deposited onto an apron feeder. The clay will then be discharged into an impact type crusher ~~having a travelling breaker plate for reduction to minus 8"~~. The reduced clay will gravitate onto ~~the Waste/Clay Conveyor~~. Optimum operation would ensure that a layer of waste material already on the belt would prevent the clay from making contact with the belt. This would minimize belt cleaning problems. Note that this clay handling ~~and reduction~~ system is preliminary and is subject to review.

The Waste/Clay Conveyor will deliver to the Drive and Transfer House located at the mine mouth. This conveyor will transfer directly onto the Waste/Clay Conveyor delivering to the Houth Meadows Mine Waste Area. Future provision has been made for the transfer of this waste material onto an alternate Waste/Clay Conveyor for delivery to the Medicine Creek Mine Waste and Ash Disposal Area. This future conveyor would originate at the Drive and Transfer House for the Mine Conveyor. Transfer points would be located at the Sampling House and two other transfer houses.

delivers onto one of the two Waste Conveyors to Houth Meadows

SECTION 6
DESIGN AND COST OF SCHEME

6.2 DESCRIPTION OF SELECTED SCHEME - cont.

6.2.3 Waste/Clay - cont.

A fourth conveyor out of the mine will be suitable for carrying waste material without clay. This conveyor will be fed by transfer conveyors from the various truck dump stations. Upon reaching the Drive and Transfer House, the waste will be discharged onto the Waste Conveyor feeding into the two Waste Bins. Distribution to the two bins will be via a bifurcated chute.

Provision has been made to allow these bins to overflow into Emergency Truck Loading Chutes should the conveyors to Houth Meadows be inoperative. Normally, the waste will be reclaimed from the bins by apron feeder with one feeder under each bin. These feeders will discharge onto a common conveyor delivering to the two Waste Conveyors to Houth Meadows. The position of a flop gate in a bifurcated chute will determine which conveyor will carry the waste to Houth Meadows.

6.2.4 Special Operating Features

As mentioned previously, the non-interchangeability of the conveying systems will not detract from the operating flexibility of the scheme. The scheme will allow all materials to be extracted from the mine (with the exception of clay) should any one conveyor be lost.

Therefore, in the event the Normal Coal Conveyor was shut down, the Low Grade Coal Conveyor could be loaded with normal coal and transfer this product to the normal coal system at the mine mouth. Similarly, the loss of a waste conveyor would place the Low Grade Coal Conveyor in a waste conveyor mode carrying waste to the Waste Bins. Homogenous clay, however, would have to be stockpiled until the Waste/Clay Conveyor resumed service.

SECTION 6

DESIGN AND COST OF SCHEME

6.2 DESCRIPTION OF SELECTED SCHEME - cont.

6.2.4 Special Operating Features - cont.

Other features in addition to back-up flexibility, include the possibility of producing normal coal from Zones A, B and C simultaneously with premium fuel from Zone D. This would be applicable in the case where the premium grade fuel stockpile at the boilers was at a low level. In this case, the Normal Coal Conveyor would carry the Zone D coal through the normal coal system and onto No. 1 Products Conveyor. This conveyor would transfer onto the Reclaim and Bypass Conveyor for delivery directly to the Power Station. Normal coal from Zones A, B and C would be carried on the Low Grade Coal Conveyor at a reduced rate to the Low Grade Coal System. The screened and crushed product would then be deposited onto No. 2 Products Conveyor for delivery to the Blending Piles.

SECTION 6

DESIGN AND COST OF SCHEME

6.3 COST SUMMARY

6.3.1 The "Order of Magnitude" Estimate on labour and material for the Material Handling, Screening and Crushing facilities, as described herein, is enclosed as Appendix 5 of this Report.

The following items are not included in this pricing:

- Land Purchase
- Excavation & Site Preparation
- Railway Tracks & Roads
- Main Power Supply
- Potable & Process Water Supply
- Construction Camp
- General Workshops & Stores Facilities
- General Offices Including Laboratory
- Sewage/Effluent Treatment & Tailings Ponds
- Drive & Transfer House for Mine Conveyors
- Waste Conveyor to Disposal & Conveyors to Blending Piles
- Reclaim Bypass & Future Waste

In addition, the following factors have not been taken into consideration:

- Contingencies
- Escalation
- Federal & Provincial Sales Taxes
- Allowance for Winter Work
- Premium Time
- Inspection & Testing
- Contract Indirects

SECTION 6

DESIGN AND COST OF SCHEME

6.3 COST SUMMARY - cont.

6.3.2 The "Order of Magnitude" Estimate on Head Office and Site/ Commissioning costs relative to the Material Handling, Screening and Crushing facilities, as described herein, is are follows:

Head Office Engineering	$1,600,000
Disbursements	275,000
Insurance	175,000
Site/Commissioning including Expenses	750,000
Risk Allowance and Fee, etc.	600,000
Project Total	$3,400,000

6.3.3 The following comments are applicable to the above costs:

a) Disbursements include such items as Travel and Living Expenses, Reproduction Costs, Telephone and Telex, etc.

b) Construction and Commissioning activities have been assumed on a continuous basis through to project completion.

c) Pricing is on a current day basis.

d) The scope of the work is as generally shown on Drawing Numbers F1490-01 and 02, Revision 2.

SECTION 7

DESIGN AND COST OF TRUCK DUMP AND IN-PIT CRUSHING UNITS

To Follow Later

SECTION 8

CONCLUSIONS AND RECOMMENDATIONS

8.1 CONCLUSIONS

8.1.1 The variety of materials to be mined and the mining plan require three separate designs of receiving and primary crushing facilities. Similarly designated duties for each mine conveyor are recommended.

8.1.2 The crushing characteristics of the various materials have not been adequately tested for final design purposes.

8.1.3 To allow better maintenance access and incorporation of alternative types of primary crushers they should not be installed under an integrated dump pocket platform. Alternative 1500-tonne per hour systems are proposed.

8.1.4 All major conveyors should be increased to ~~1.37~~ 1400 meters (54 inches) wide.

8.1.5 Beneficiation of the Low Grade coal by dry screening will give a useful recovery of coal. The costs of wet beneficiation could not be justified on the basis of present limited data.

8.1.6 Incorporation of Low Grade coal beneficiation will supplement the selective mining operation, and the scheme devised improves mine operational flexibility.

8.2 RECOMMENDATIONS FOR FUTURE TESTWORK PROGRAMS

8.2.1 Crushing and General Characteristics of Run-of-mine Materials

Bulk samples must be obtained representative of the various run-of-mine materials for testing. (It is appreciated that some materials will not be accessible until partway through the mine development. Scheme layouts cannot therefore be finalized at lower mine levels at a pre-mining stage. Similarly mine-mouth layouts should allow for changes in requirements, eg. for beneficiation plant).

SECTION 8

CONCLUSIONS AND RECOMMENDATIONS

8.2 RECOMMENDATIONS FOR FUTURE TESTWORK PROGRAMS

8.2.1 Crushing and General Characteristics of Run-of-mine Materials - cont.

a) Run-of-mine size analysis and size analysis following alternative crushing and handling operations for each material.

b) Breaking characteristics of the better coals. If these are harder than waste materials can beneficiation by selective crushing and screening be accomplished? Would a Bradford Breaker reject good coal along with petrified wood and clay?

c) Identification of the problems with Petrified Wood:
- is sulphur associated with some petrified materials?
- could Impactor crushers allow scalping off this material after their use for primary breaking?
- is the material so hard that damage may be done to simpler types of crusher, eg. the "Wing" crusher?
- could a Bradford Breaker reject this material from say 200 x 50mm raw coal at the secondary crushing stage?

d) Determination of practical methods of dealing with claystone waste:
- moisture content, crushing and handling characteristics when mined in anticipated conditions

8.2.2 Borecore Test Programs

Since bulk samples can only be obtained from many areas after mining has advanced, it will be necessary to obtain data from suitable large diameter (200mm) drill cores. In many cases they should facilitate answers to the above questions subject only to final design stage confirmation - for example examination of the clay material.

The program must first establish the applicability and technique of the method by comparison with data from adjacent bulk sample trenches.

SECTION 8

CONCLUSIONS AND RECOMMENDATIONS

8.2 RECOMMENDATIONS FOR FUTURE TESTWORK PROGRAMS - cont.

8.2.2 Borecore Test Programs - cont.

It is not anticipated that a large number of these drill cores will be required. (Their situation can be determined from existing small diameter core results to ensure that the complete range of materials is sampled). Due to the thickness of the measures each core would produce a significant sample weight.

a) Dry tumbling tests and wet attrition tests to establish raw coal size consist and washability data of coal zones which have not been sampled. This is of importance for confirmation of the Coal Beneficiation Report as well as to investigate true Low Grade Coal samples.

b) Samples of all materials for practical classification by crushing and handling equipment manufacturers.

8.2.3 Crushing Tests

There are no standard test procedures, since each type of crusher makes use of different characteristics. Specific requirements should be determined by consultation with each crusher manufacturer. We suggest initially the following should be involved:

Pennsylvania Crushers re Bradford Breakers
Krupp-Canada re Siebra Screen/Crusher
Hammermills Inc.
Hazemag Canada
Jeffrey Canada

Specific attention should be paid to the characteristics of the 8" x 2" fraction after primary breaking at 8".

SECTION 8

CONCLUSIONS AND RECOMMENDATIONS

8.2 RECOMMENDATIONS FOR FUTURE TESTWORK PROGRAMS - cont.

8.2.4 Handling Characteristics

a) A series of 2" x 0 coal qualities should be tested at various surface moisture contents between 3% and 10%. (The plant designers should be able to project chute angles for the coarser fractions from these tests). The NCB (UK) Shear Cell method is recommended.

b) A series of ½" x 0 coal qualities should be similarly tested.

c) Clay samples must be submitted to specialist equipment manufacturers.

8.2.5 Screening Performance

As operating experience becomes available for the Probability and Disc screens the advice of screen manufacturers should be sought to update the predictions given in this report. Data from 8.2.4 may be of assistance in this area.

8.2.6 Pilot Plant

This will be essential for any wet processing proposal. The requirements can only be designed after 8.2.2 (a) test results have been fully analyzed.

8.3 RECOMMENDED DESIGN FEATURES

8.3.1 Steel Chute analysis must be employed in all situations. See proposed scheme drawings.

8.3.2 For the clay waste, chutes should be avoided where possible, i.e. there should be vertical delivery from one conveyor to the next. Where chutes are unavoidable self-cleaning, eg. air-operated Linatex pads, should be allowed in design.

SECTION 8

CONCLUSIONS AND RECOMMENDATIONS

8.3 RECOMMENDED DESIGN FEATURES - cont.

8.3.3 Bunkers and hoppers should be of mass flow design. Provisions should be made for air cannons to be installed, or possibly low friction liners.

8.3.4 Truck Dump hoppers should be designed to eliminate characteristic "dead pockets". Although these could protect the hopper bottom and apron feeders from damage by large boulders, they would in practice allow clay build-up to start. Truck dump hoppers should therefore be lined with steel plates.

8.3.5 Automatic controls should allow the Crushing Plant hoppers to run less than half-full. The mine conveyors would then be able to empty into these hoppers before stopping.

8.3.6 The truck dumps and hoppers should only be left with material inside during emergency shutdown. This will reduce material hanging up in the short term. If a hopper is left full for longer periods, ie several shifts, there will be a possibility of heating, and remotely, one of spontaneous combustion.

8.3.7 Stockpiles should be avoided to reduce the risks of spontaneous combustion. The only piles currently envisaged within the mine system is the blending system. The 50mm x 0 product is less likely to heat up than piles of coarser material.

APPENDIX I

BENEFICIATION BY WET SCREENING

The following data sets were examined:

1977 Sample Z : After Wet Attrition
1977 Sample Y : After Wet Attrition
1977 Sample X : After Wet Attrition
CANMET Wet Screening Tests : Table 2 Wet Screening
CANMET 3/8" x 0 Crushed Raw Coal Test Run 7, Table II-12
1979 Sample : Wet Screening, stirring and Wet Screening

By plotting these results in the form cumulative % weight vs cumulative % ash (dry basis) the trend of increasing ash content in the finer particles was found to be a set of parallel lines (similar to, but steeper than, those for the Dry Screening, Figure III-1).

The 1977 Sample Z results were found not to conform to the steep slope pattern of the other samples. Since this low ash (D Zone coal) contains noticeably less coal, and this sample was considered irrelevant to the consideration of Low Grade Coals.

The 1979 Sample showed that at higher ash contents the differential is lower. Mass/ash balances confirmed this.

For purposes of calculating the beneficiation which could be achieved by desliming the removal of 25% by weight was considered - this is equivalent to a practical separation using a 1mm aperture Sieve Bend and a 1/2mm aperture wedge wire Screen.

For the material at 45% ash, the theoretical separation gives a 38.15% ash product at 75% yield. To allow for misplaced material the actual separation was taken as 39% ash, i.e. a differential of 6% ash. This differential was reduced to 3% ash at 73% raw coal as discussed above.

APPENDIX II

CORRELATION OF WASHABILITY DATA

Considerable time was spent trying to define the washability data trends as generally observed.

This was done on the usual basis of raw coal and product ash contents and yields for a series of separating gravities. The data was examined for each individual size range, and also for the composite plus 100 mesh. It can be seen from the examples in Tables II-1 and II-2 that the trends were by no means conclusive and would not permit meaningful interpolation or extrapolation. Thus prediction of the beneficiation product qualities and yields for untested intermediate coals, and more particularly the Low Grade coals was thought to be impracticable. (This exercise was computer assisted).

However, an alternate method revealed an unexpected and relatively good correlation which may be unique to Hat Creek. (Hopefully not unique to these five sets of washability data!) This correlation was found between the raw coal ash content and clean coal ash content for a series of clean coal yield values. (The yield values chosen were 80%, 70% and 60%. These yields are achieved at widely differing gravities, yet, all the gravities thus required lie within the working range of the appropriate washing equipment for the respective coal size fractions).

Even more surprising is the fact that at a given yield value a single correlation curve applies to each size fraction.

The quality/yield values were obtained from the interpolated washability data (see Appendix III of the Alternate Beneficiation Report) and the curves shown in Figures II-1 and II-2 were determined by a computerized quadratic curve fit.

> (Results from the first curve fit included points marked "R" obtained from the second (cumulative) washability test conducted by CSMT on the 1976 Sample A, 28 x 100 mesh size fraction.
>
> Computations from this first curve fit showed inexplicably high rejects ash contents/high degrees of beneficiation for poorer coals. Reference to the test report shows this point to be very dubious as it is largely dependent on the 1.90 S.G. Sinks ash content which had been "modified" to 95.0% ash. The earlier CSMT results yielded the points marked "A", which although not included in the curve fit, give credence to the use of these curves at the higher ash values).

Subsequently, the data from the CANMET Wast Test (reconstituted feed) has been examined and found to conform to these correlations. This is significant due to the large quantity of fines produced by crushing and wet attrition.

TABLE II-1

Quality Variation of Floats Product (at 1.80 S.G.) Compared to Raw Coal for Plus 1/2 Size Fractions

Sample	Ash Content of Raw Coal Size Fraction	Floats Product at 1.8 S.G. % Ash	Floats Product at 1.8 S.G. Wt. % Yield
A 2" x 1"	43.4	36.0	86.3
1" x ½"	45.7	39.5	88.7
X 4" x ½"	39.2	33.1	87.0
Y 4" x ½"	35.3	25.0	81.1
B 2" x 1"	25.6	22.4	92.9
1" x ½"	30.0	27.2	93.7
Z 4" x 1"	27.1	26.7	99.1
1" x ½"	27.3	26.2	97.8
C 2" x 1"	24.0	19.1	91.6
1" x ½"	22.1	18.8	94.0

TABLE II-2

Quality Variation of Floats Product (at 1.80 S.G.) Compared to Raw Coal (Composite)

Sample	Ash Content of Raw Coal	Ash Content of 1.80 S.G. Floats Product
A	50.1	27.2
X	44.7	33.7
Y	42.1	41.7
B	36.4	27.7
Z	27.7	25.9
C	27.7	21.5

FIG II-1

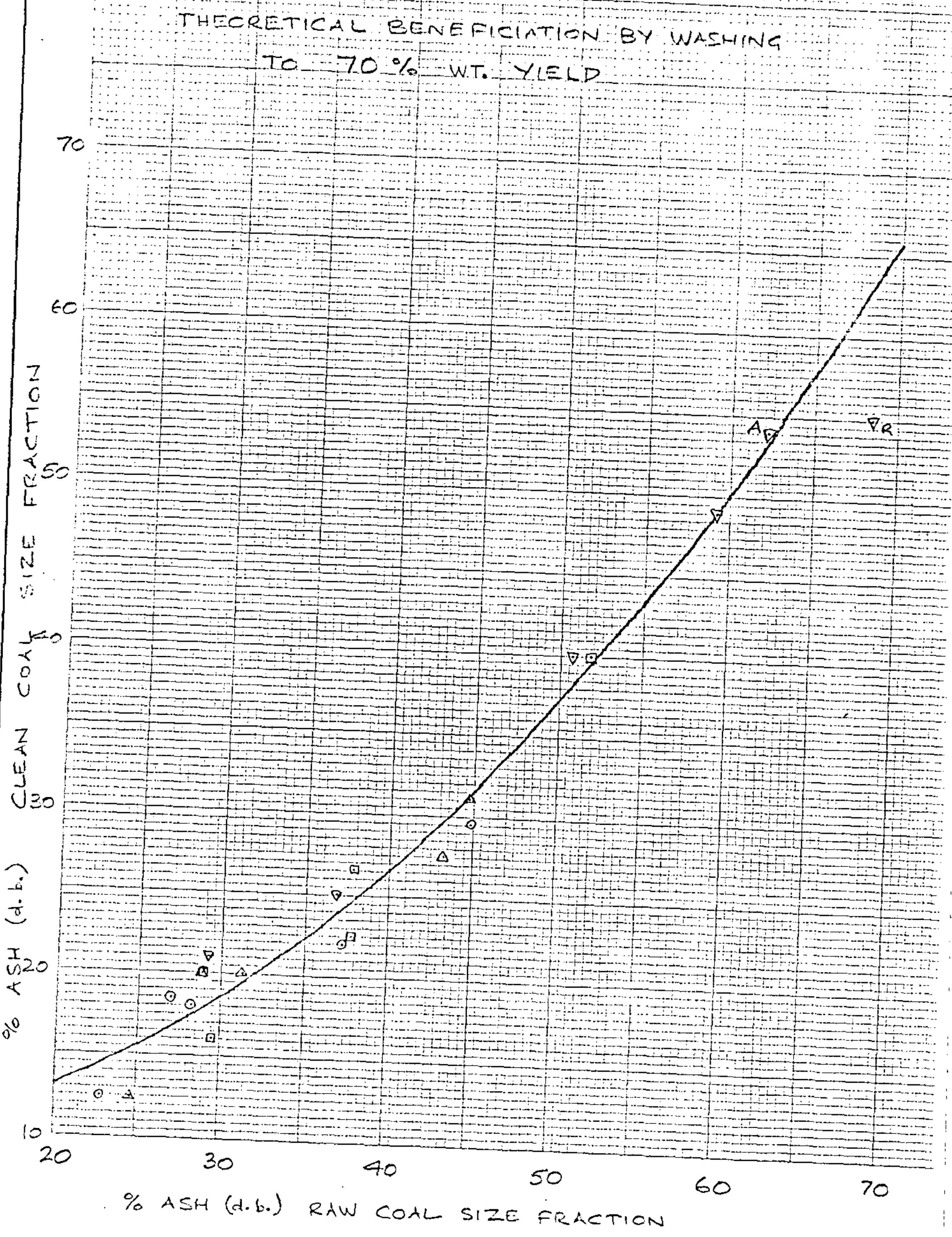
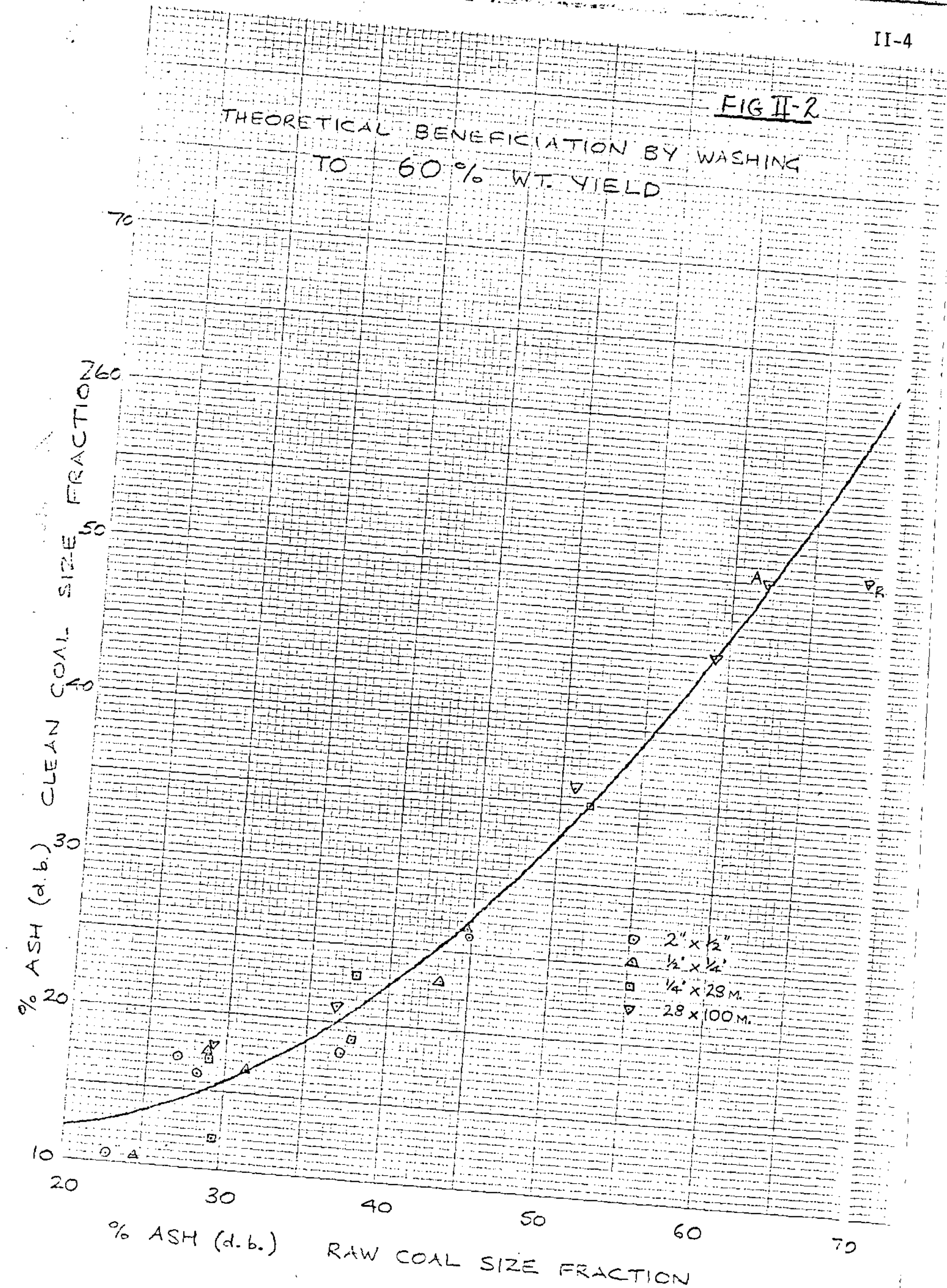

THEORETICAL BENEFICIATION BY WASHING
TO 70% WT. YIELD
70
60
50
40
30
20
10
% ASH (d.b.) CLEAN COAL SIZE FRACTION
20
30
40
50
60
70
% ASH (d.b.) RAW COAL SIZE FRACTION
A
R

FIG II-2


THEORETICAL BENEFICIATION BY WASHING
TO 60% WT. YIELD
% ASH (d.b.) CLEAN COAL SIZE FRACTION
% ASH (d.b.) RAW COAL SIZE FRACTION
10
20
30
40
50
60
70
2" x ½"
½" x ¼"
¼" x 28 M.
28 x 100 M.
A
R

APPENDIX III

CORRELATION OF DRY SCREENING DATA

The data, plotted with instantaneous ash versus particle size, indicated a general trend of increasing ash with decreasing grain size. The only exception to this trend was the first sample from 1979 sampling (designated as NEW 1) which showed the reverse trend namely decreasing ash with decreasing grain size. This anomaly is attributed to the head ash of this sample being greater than the other seven samples.

Therefore, it is concluded that as head ash increases, the trend to increasing ash with decreasing size diminishes and eventually reverses. This implies that there exists at some unknown head ash a coal of constant ash independent of particle size. Insufficient testwork does not permit this point to be ascertained.

Although the family of curves exhibits a similar geometric shape (except of NEW 1) the differences are such that confident predictions cannot be based on them. Therefore the eight samples were replotted on the basis of cumulative ash versus cumulative weight for decreasing size. This graph is shown on Figure III-1.

From Figure III-1 a definite, repeatable trend can be seen for all samples. The exception is for sample NEW 1, however this sample presents a "mirror image" of the other seven. The seven similar samples were combined to give an average distribution of cumulative ash versus cumulative weight. This was done by reading off the cumulative ash for each sample at the cumulative weights of 15%, 20%, 30%, 40%, 50%, 60%, 70%, 90%, and 100%. The arithmetic mean of the various cumulative ashes at each point was calculated.

From the above, it was possible to compute the ash distribution for any given head ash. Table III-1 below summarizes the predicted ash distribution for the coal for decreasing size.

APPENDIX III

CORRELATION OF DRY SCREENING DATA

TABLE III-1

CUMULATIVE WEIGHT	CUMULATIVE ASH %
15%	(head ash - 10.87)
20%	(head ash - 10.17)
30%	(head ash - 8.83)
40%	(head ash - 7.74)
50%	(head ash - 6.84)
60%	(head ash - 5.90)
70%	(head ash - 4.76)
80%	(head ash - 3.36)
90%	(head ash - 1.73)
100%	(head ash)

The average size consist used in this exercise is shown in Table III-2 (which is Table 3-3 of the July 1978 report, column 1)

APPENDIX III

CORRELATION OF DRY SCREENING DATA

TABLE III-2

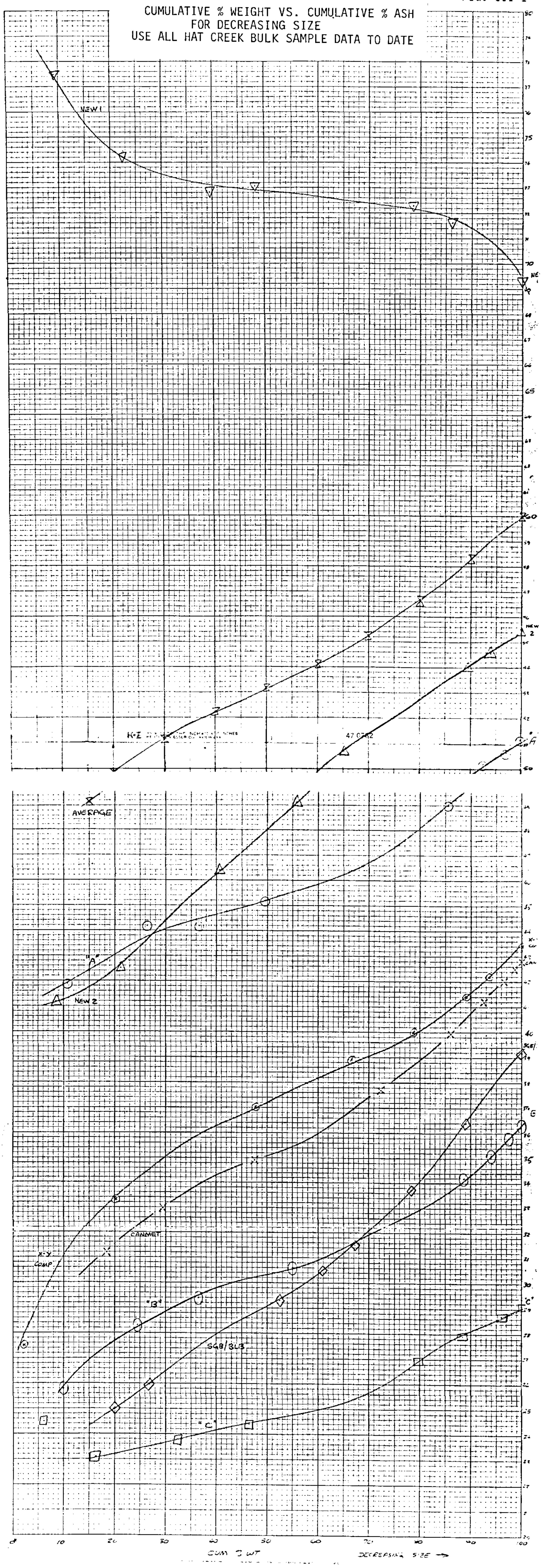
SIZE(mm)	% WEIGHT	CUMULATIVE WT.
200 x 50	15.0	15.0
20 x 25	18.0	33.0
25 x 13	26.0	59.0
13 x 6	15.0	74.0
6 x 3	10.0	84.0
3 x 1.5	7.0	91.0
1.5 x 0.6	4.0	95.0
0.6 x 0	5.0	100.0

However, this size consist was not compatible with the size consist used in Table III-1 which had cumulative weight at 15%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90%, and 100%. Therefore the size consist in Table III-2 above was plotted and the sizes at which the above cumulative weight figures corresponded to were read off. This re-weighted size consist is shown in Table III-3 below.

TABLE III-3

SIZE (mm)	% WEIGHT	CUMULATIVE WT.
200 x 50	15.0	15.0
50 x 38	5.0	20.0
38 x 27	10.0	30.0
27 x 20.8	10.0	40.0
20.8 x 16	10.0	50.0
16 x 12.5	10.0	60.0
12.5 x 8.2	10.0	70.0
8.2 x 3.9	10.0	80.0
3.9 x 1.8	10.0	90.0
1.8 x 0	10.0	100.0

FIG. III-1


CUMULATIVE % WEIGHT VS. CUMULATIVE % ASH
FOR DECREASING SIZE
USE ALL HAT CREEK BULK SAMPLE DATA TO DATE
NEW 1
NEW 2
AVERAGE
"A"
CANMET
X-Y COMP
"B"
SGB/3LB
"C"
CUM % WT
DECREASING SIZE →

APPENDIX IV

GIVEN DATA

Warnock Hersey Professional Services Ltd.

DATE: AUGUST 17, 1979

CLIENT: B.C. HYDRO

780 - 0450

SAMPLE I.D. : TRENCH A

LAB. NO. : 79 - 7077

HEAD SAMPLE: ASH % = 59.6 B.T.U./LB. = 3912

SCREEN ANALYSIS /ASH/B.T.U/ DISTRIBUTION

SCREEN ANALYSIS		A			B	
PASSING	RETAINED	WT %	DRY ASH %	B.T.U./LB.	WT %	DRY ASH %
	1/4 "	24.3	47.7	5723	12.4	32.4
1/4"	8 M	25.4	54.3	4809	7.1	37.9
8 M	16 M	12.4	59.2	4337	15.7	48.7
16 M	28 M	8.1	58.2	4208	28.5	62.2
28 M	48 M	7.9	64.3	3345	8.8	67.7
48 M	100 M	6.8	69.4	2661	8.0	70.8
100 M	200 M	4.5	71.2	2410	5.6	72.1
200 M	325 M	2.4	74.5	2450	2.4	76.7
325 M	0	8.2	79.2	2135	11.5	80.0
TOTAL		100.0	58.7	4278	100.0	58.9

A. WET SCREEN, SQUARE HOLE.

B. PRE - WETTING PERIOD TEN MINUTES. WET SCREEN, SQUARE HOLE

SUBMITTED AUGUST 17, 1979

John Kay

JOHN KAY, C.ENG., M.INST.E.
LABORATORY MANAGER

inter-office memo

MEMO TO: W. E. MEEKS — 14 August 1979

FROM: B. DUTT — File: 604H-126.2-8, 604H-1301.1-3, 604H-1301.4-2, 604H-1301.4-7

SUBJECT: Wet Screening Analyses At Warnock Hersey, Calgary

The -½" fraction from Trench A, 2nd Screen Analysis was subjected to Wet Screening at Warnock Hersey Laboratory in Calgary.

A head sample was taken first to balance the calculated ash-Btu of the various fractions. Two sets of tests were conducted:

i) Pre-treating the coal in a pail of water mildly agitating it for five minutes.

ii) Direct wet screening: removing ¼" and 8mesh fraction using water hose and treating the rest in a Cascade set up for fractional analysis.

The analyses are below:

Screen Size	% of -½" fraction	% of Total wt.*	Ash (db)	Btu/lb (db)
½" x ¼"	24.3	10.78	47.7	5723
¼" x 8 m	25.4	11.27	54.3	4809
8 mesh x 16 mesh	12.4	5.50	59.2	4337
16 mesh x 28 mesh	8.1	3.60	58.2	4208
28 mesh x 48 mesh	7.9	3.51	64.3	3345
48 mesh x 100 mesh	6.8	3.01	69.4	2661
100 mesh x 200 mesh	4.5	2.00	71.2	2410
200 mesh x 325 mesh	2.4	1.06	74.5	2450
325 mesh x 0	8.2	3.64	79.2	2135
Head Analysis				
½" x 0	-	-	59.6	3912

* Based on Commercial Testing analysis of 13 July 1979
½" x 0 constitutes 44.4% of Total Wt.

Note: On calculated basis the ½" x 0 fraction indicates 58.7% ash (db) and 4210 Btu/lb (db). The calculated Btu is higher by 300 than the experimental value. This is being investigated.

...2

The -325 mesh material in suspension does not precipitate readily. Of the several coagulents used during the course of the test, TCH-399, a cationic reagent marketed by TURBO was found to be very effective. Within 3-5 mts. about 90% of the material in suspension tended to coagulate and precipitate. It is suggested that further tests with other chemical reagents be undertaken to establish the effectiveness. The two major advantages appear to be recovery of any carbonaceous material from the suspension, and secondly the reduction in precipitation time in the settling ponds.

BD:rak

Attachment (Data sheet of TURBO TCH-399)

cc: J. J. Fitzpatrick
W. C. Fothergill
D. K. Whish
H. Kim

F-464

COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 228 NORTH LA SALLE STREET, CHICAGO, ILLINOIS 60601 · AREA CODE 312 726-8434

RESIDENT MANAGER
WESTERN CANADA OPERATIONS
BRUCE E. LAWRENCE

SINCE 1908

PLEASE ADDRESS ALL CORRESPONDENCE TO:
147 RIVERSIDE DRIVE, NORTH VANCOUVER, B.C.
V7H 1T6, CANADA
OFFICE TEL. (604) 929-2228

July 13, 1979

BC HYDRO ENGINEERING GROUP
555 W. Hastings Street
Box 12121
VANCOUVER, BC
V6B 4T6

Sample identification - by BC Hydro

Kind of sample reported to us: Trench A, 2nd Screen Analysis

Sample taken at: ------

Sample taken by: ------

Date sampled: ------

Date received: July 9, 1979

Analysis report no. 64-18932 thru 18936
18940 thru 18943

SIZE	LAB NO.	MOISTURE	% DRY WT.	DRY BASIS ASH	DRY BASIS SULPHUR	DRY BASIS BTU
+ 4"	18933	25.93	8.6	41.17	0.58	6712
4" x 2"	18934	22.02	12.6	43.47	0.67	6966
2" x 1"	18935	24.18	19.6	50.60	0.58	5714
1" x 1/2"	18936	23.96	14.8	56.61	0.55	4457
1/2" x 1/4"	18940	22.83	9.5	59.87	0.47	4209
1/4" x 16m	18941	21.88	24.4	62.89	0.57	3628
16m x 28m	18942	22.23	4.4	66.05	0.60	3130
28m x 0	18943	18.60	6.1	68.43	0.76	2750
			100.0			
1/2" x 0	18932	23.37	44.4	60.95	0.53	3744
Raw Coal: (Calculated Dry Basis)		23.67	100	55.43	0.59	4825

Bulk Density Test 1/2" x 0 — 266 lbs. Gross (21.1 lb. = box)
244.9 lbs. Net

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.
Division of Peabody International (Canada) Ltd.

B. E. Lawrence
Regional Manager

Charter Member

Commercial Testing & Engineering Co.

CONSULTING FUEL ENGINEERS
AND CHEMISTS

CHICAGO, ILL.

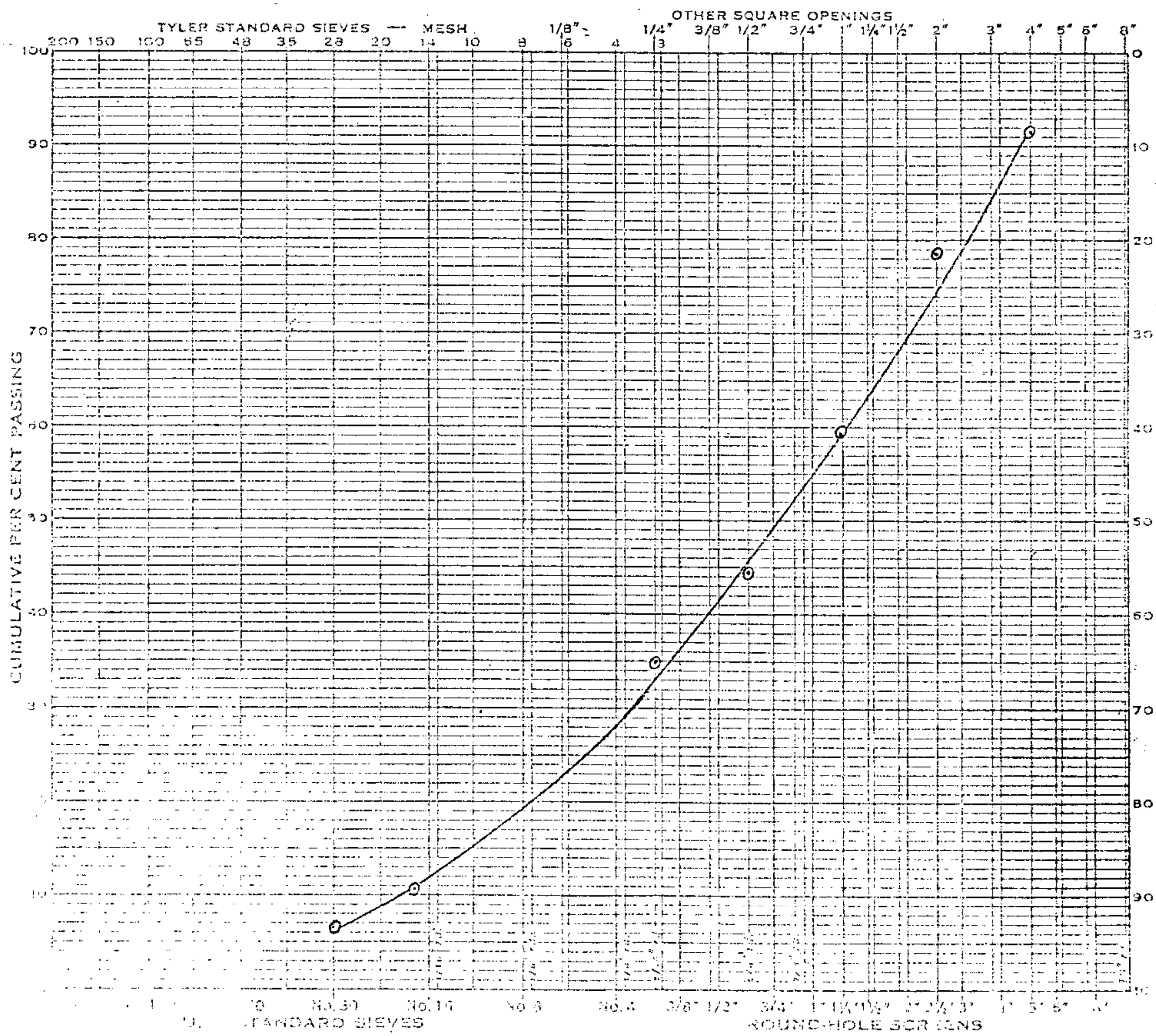
Charleston, W. Va. — Terre Haute, Ind.

Description BC Hydro Screen Test, Trench A, 2nd Screen Analysis

Total Weight of Sample 2300 lbs.

Date July 13, 197

SCREEN ANALYSIS CURVE



Form SC 3M 9-49

"Reproduced by permission of Eastern Gas & Fuel Associates, Coal Division" inter-office memo

MEMO TO: W. E. MEEKS

17 July 1979

FROM: B. DUTT

File: 604H-126.2-8
604H-1301.1-3
604H-1301.4-2
604H-1301.4-7

SUBJECT: Possible Beneficiation of Low Grade Coal By Screening - Screen Test No. 2

Screen Test No. 1 showed an overall ash of 72.26% (db) and thermal value of 1906 Btu (db). As mentioned in my memo of 5 July 1979, it was virtually impossible to select a suitable site for obtaining samples of the required grade viz 3000-4000 Btu/lb (db) without diluting the coal sample with waste material.

It may be of interest to note that the quality of this coal, 1906 Btu/lb (db), is in the range (2000 Btu/lb db) suggested by the Energy Conservation Authorities to be the permissible reject.

On request from Simon-Carves, their telex of 4 July 1979, a second sample was taken from a trench at the foot of the northern wall. Effort was made to take a representative, unbiased sample, incorporating claystone band as it naturally occurs.

Initial screening using 4", 2", 1" and ½" screens was conducted at site, the respective weights recorded.

Effort was made to maintain natural moisture levels - excessive drying was prevented.

The Field Screen Analysis is as follows:

Retained on Screen Size	Weight lbs	Weight % of Total As Received	Weight % of Total Dry Basis
+4"	206.0	9.0	8.6
+2"	289.0	12.6	12.6
+1"	461.0	20.0	19.6
+½"	348.8	15.2	14.8
-½"	995.5	43.2	44.4
Total	2300.3	100.0	100.0

The calculated quality of the total sample (+4" to -½") on (db) is 23.67% moisture, 55.43% ash, 0.59% S and 4825 Btu/lb.

The bulk density of the -½" x 0 fraction is 903.0 kg/m^3 with 23.37% total moisture, 60.95% ash (db), 0.53% S (db) and 3744 Btu/lb (db).

...2

FORM 91903(8/72)

The analysis of -½" x 0 fraction was carried out at Commerical Testing in Vancouver. All screening was done with the total moisture - without thermal drying, partial or otherwise. The screening was slow at fraction -¼" and below, yet not too difficult.

BD:rak

cc: J. J. Fitzpatrick
W. C. Fothergill
D. K. Whish
C. R. Welton
H. Kim

inter-office memo

MEMO TO: W. E. MEEKS — 5 July 1979

FROM: B. DUTT — File: 604H-126.2-8, 604H-1301.1-3, 604H-1301.4-2, 604H-1301.4-7

SUBJECT: Possible Beneficiation of Low Grade Material by Screening

---

Simon-Carves have been assigned to investigate the possible beneficiation of low grade material at Hat Creek. The two low grade cutoffs were required to be at about 3000 Btu/lb and at 4000 Btu/lb.

The writer had the responsibility of selecting the suitable sampling sites and carrying out screening at +4", 4" x 2", 2" x 1", 1" x ½", and -½" x 0.

The last fraction, -½" x 0, was to be screened at Commercial Testing, Vancouver. Ash and total moisture was also to be determined for all fractions up to -½". Trench A offered the ideally exposed section with proper analytical records available from the Bulk Sampling Program of 1977.

A detailed study of the bench faces showed almost complete absence of the desired "low grade" material. It would be imprudent to obtain such material by blending coal with waste in the required amount to produce the "sample". Hence, the only site towards the eastern coal limit of the pit was selected. A rough ash determination of the sample was around 70%.

It was, therefore, decided to go ahead with one sample only at the ash level slightly higher than the required one of around 65% (db).

Sampling Procedure

A backhoe was used to open up a trench about 5' wide and 15' long at the base of the dark coloured coaly claystone band. The surface material up to a depth of 1' was cleared to expose fresh coal.

The coal was wet, slightly weathered and oxidized. The backhoe lifted up a bucketful of sample at a time and dropped it gently on the 4" screen. The lower screens 2", 1" and ½" were installed as shelves.

There were very few pieces of +4" material, hence the sample weight was kept at 1 ton, instead of 2 tons as envisaged earlier.

The heaviest plugged screen was ½"; to screen any finer the coal had to be dried.

One barrel of -½" coal fraction was brought to Commercial Testing for screening at ¼", 16 mesh, 28 mesh and -28 mesh.

...2

The samples had to be partially dried, as suspected, before it could be screened.

The field screen analysis is as follows:

Retained on Screen Size	Weight	Weight,% of Total
+4"	54.75 lb.	9.2
+2"	153.25 lb.	
+1"	308.00 lb.	13.2
+½"	395.50 lb.	17.1
-½"	1411.40 lb.	61.5
	2322.90 lb.	100.0%

The bulk density of the above material -2" x 0 (the fraction which the mine is required to produce) is 1143 kg/m^3 with 29.24% total moisture and 72.26% ash (db).

Bulk Density Determination of Coal & Coaly Material

A measuring-box 50 cm x 50 cm x 50 cm (or 1/8 of m^3) was used to determine the bulk density of materials obtained from the stockpiles at the Bradford Breaker site.

Sample I.D.		Ash(db)	Total Moisture	Bulk Density (w/total moisture kg/m^3)
Stockpile C	High Grade	32.12	26.04	903.56
Stockpile B	Low Grade	50.75	28.50	965.33
Stockpile A	Shipping Grade	46.56	27.95	922.00

BD:rak

cc: J. J. Fitzpatrick
W. C. Fothergill
D. K. Whish
C. R. Welton
H. Kim

F-465

DBN

COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 228 NORTH LA SALLE STREET, CHICAGO, ILLINOIS 60601 · AREA CODE 312 726-8434

RESIDENT MANAGER
WESTERN CANADA OPERATIONS
BRUCE E. LAWRENCE

SINCE 1908

PLEASE ADDRESS ALL CORRESPONDENCE TO:
147 RIVERSIDE DRIVE, NORTH VANCOUVER, B.C.
V7H 1T6, CANADA
OFFICE TEL. (604) 929-2228

JUL 4 1979

June 29, 1979

BC HYDRO & POWER AUTHORITY
555 W. Hastings Street
Box 12121
VANCOUVER, BC
V6B 4T6

ATTN: Mr. B. Dutt

Project: Screen Test Analysis from Trench A

SAMPLE I.D.	Lab NO.	ASH	MOISTURE
Stockpile C High Grade Bulk Density	18890	32.12	26.04
Stockpile B Low Grade Bulk Density	18891	50.75	28.50
Stockpile A Shipping Grade Bulk Density	18892	46.56	27.95
-2" Low Grade Bulk Density (Trench A from Sample Site)	18893	72.26	29.24
+2" Trench A Screen Test	18894	77.49	25.97
1"x1" Trench A Screen Test	18895	71.89	28.25
1/2"x1" "	18896	71.01	27.54
1/2"x1/4" "	18889-1	74.09	28.25 (run on
1/4"x16 mesh "	18889-2	71.02	" -1/2" coal)
16m x28 mesh "	18889-3	64.96	"
-28 mesh "	18889-4	54.98	"

SCREEN ANALYSIS (-1/2" As Tested)

	Wt. (Dry lbs.)	% Wt.	Actual Wt. (lbs. partly dried)
1/2" x 1/4"	44.5	14.6	52.4
1/4" x 16m	153.0	50.2	187.8
16m x 28m	37.5	12.3	45.3
28m x 0	70.0	22.9	89.4
		100.0	

RAW COAL (Calculated Dry Basis)

+2"	9.2
2" x 1"	13.2
1" x 1/2"	17.1
1/2" x 1/4"	8.8
1/4" x 16m	30.4
16m x 28m	7.4
28m x 0	13.9
	100.0

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Bruce Lawrence

Charter Member

Commercial Testing & Engineering Co.

CONSULTING FUEL ENGINEERS
AND CHEMISTS

CHICAGO, ILL.

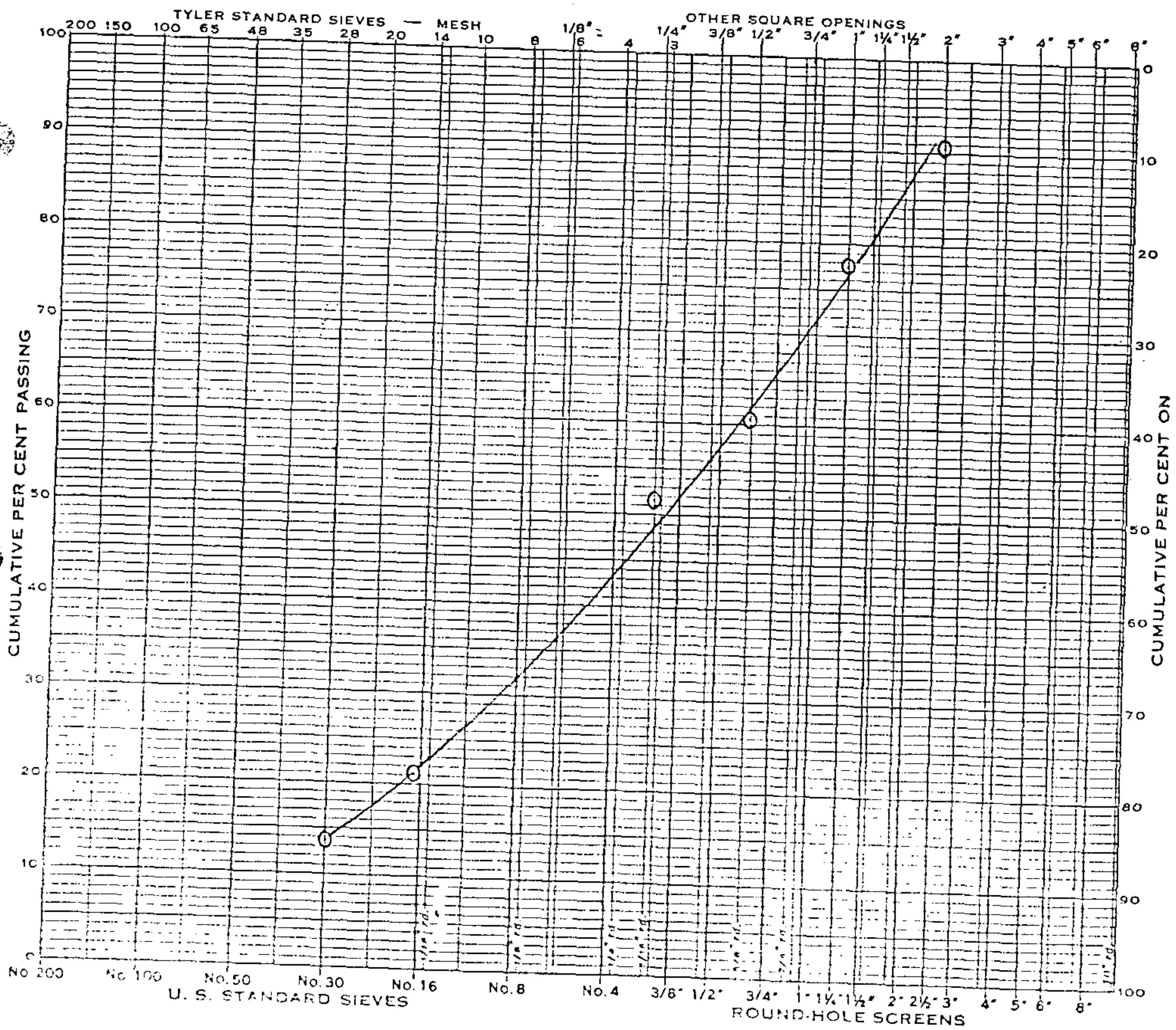
Charleston, W. Va. Terre Haute, Ind.

Description BC Hydro Screen Test Trench A

Total Weight of Sample 2000 lbs.

Date June 29/79

SCREEN ANALYSIS CURVE



NOTE: SCREEN OPENINGS ON LOGARITHMIC SCALE WITH = 1.25

Form SC 3M 9-49

APPENDIX V

ESTIMATE SUMMARY

ESTIMATE SUMMARY SIMON-CARVES OF CANADA LTD 2025 Sheppard Avenue East Willowdale, Ontario M2J 1W2	CLIENT B.C. HYDRO PROJECT HAT CREEK. LOCATION	DESCRIPTION ESTIMATE SUMMARY	PROJECT NO. F. 1490 SHEET OF

EST'D [illegible] DATE AUG. 31-79

CODE	ITEM	EQUIPMENT	MATERIAL	FRT./DUTY	LABOUR	SUB/CONT.	TOTAL
	STRUCT. ST. & CONCRETE ETC.						5,214,320
	MECH. & PL'WK.	5491587	535930	186760	1751205		8402475
	ELECTRICAL.						2,203,000
	EXCL. FROM EST:-						
	CONT'CY, FST. & PST,						
	EXCAV. & SITE PREP.						
	DRIVE & TR'FER. HSE. FOR MINE CONV'RS.						
	WASTE CONV'R TO DISPOSAL.						
	CONV'RS TO:- BLENDING PILES,						
	RECLAIM BY-PASS, & FUTURE WASTE.						
							15,819,795

ESTIMATE SUMMARY SIMON-CARVES OF CANADA LTD 2025 Sheppard Avenue East Willowdale, Ontario M2J 1W2	CLIENT PROJECT [illegible] LOCATION	DESCRIPTION Bldg. Summary.	PROJECT NO. F. 1470 SHEET OF

EST'D [illegible] DATE AUG 79.

CODE	ITEM	TOTAL COST: EQUIPMENT	MATERIAL	FRT./DUTY	LABOUR	SUB/CONT.	TOTAL
	Struct. Steel						3,333,200
	Earthwork & Concrete.						867800
	[illegible]						1,013,320
							5,214,320

ESTIMATE SIMON-CARVES OF CANADA LTD 2025 Sheppard Avenue East Willowdale, Ontario M2J 1W2	CLIENT PROJECT Hat Creek LOCATION	DESCRIPTION Struct. Steel EST'D DATE	PROJECT NO. [illegible] SHEET OF

	ITEM	UNIT	QTY.	UNIT COST	UNIT M/H	EQUIPMENT	MATERIAL	FRT./DUTY	LABOUR	SUB/CONT.	TOTAL
	Struct. Framing	T	990	1500							1,485,000
	Stairs & misc.	T	63	2200							138,600
	Handrail	T	32	3200							102,400
	1¼" x 3/16" grating	T	110	1600							176,000
	1¼" x 3/16" thk. floor plate.	T	56	1200							67200
					C/F.						1969200

ESTIMATE		
SIMON-CARVES OF CANADA LTD. 2025 Sheppard Avenue East Willowdale, Ontario M2J 1W2	CLIENT	
	PROJECT	Hot Stack
	LOCATION	

DESCRIPTION	Struct. Steel	PROJECT NO. F. 147[illegible]
EST'D	DATE	SHEET OF

	ITEM	UNIT	QTY.	UNIT COST	UNIT M/H	EQUIPMENT	MATERIAL	FRT./DUTY	LABOUR	SUB/CONT.	TOTAL
					B/F						1,969,200
	Cont'd gallr.	T	520	1400							723,000
	Bin Plates '16' ± 3/8'	T.	140	2000							280,000
	Bin Stiffeners	T.	70	2000							140,000
	1/2" Wear plates.	T	72	3000							216,000
											3333,200

ESTIMATE

SIMON-CARVES OF CANADA LTD.
2025 Sheppard Avenue East
Willowdale, Ontario M2J 1W2

CLIENT

PROJECT Mat. bank.

LOCATION

DESCRIPTION Substruct. & Concrete.

PROJECT NO. E. 11[illegible]

EST'D

DATE

SHEET OF

	ITEM	UNIT	QTY.	UNIT COST	UNIT M/H	TOTAL COST: EQUIPMENT	MATERIAL	FRT./DUTY	LABOUR	SUB/CONT.	TOTAL
	Excavation	C.Y.	22000			BY OWNER SEE MINUTES. AUG. 29/74.					
	Struct. fill	C.Y.	5000	7.00							35,000
	Backfill	C.Y.	15000	4.25							63,750
	Suspended slabs.	C.Y.	528	350							184,800
	S.O.G., Piers & Walls.	C.Y.	2337	250							584,250
											867,800

ESTIMATE

SIMON-CARVES OF CANADA LTD.
2025 Sheppard Avenue East
Willowdale, Ontario M2J 1W2

CLIENT

PROJECT Hot Strip

LOCATION

DESCRIPTION Building cost

PROJECT NO. T. 1490

EST'D

DATE

SHEET OF

	ITEM	UNIT	QTY.	UNIT COST	UNIT M/H	TOTAL COST: EQUIPMENT	MATERIAL	FRT./DUTY	LABOUR	SUB/CONT.	TOTAL
	54" conveyor hood. 1300 lf		321,000	0.65							208,650
	Insul. roof cladding	s.f.	39,000	5.00							195,000
	Insul. wall cladding	s.f.	120,000	4.50							540,000
	Single skin roof.	s.f.	10,100	1.70							17,170
	Single skin siding	s.f.	35000	1.50							52,500
											1013320

F1490 AUGUST 9th 1979

B.C. HYDRO —— HAT CREEK . SHEET 1

1. ITEM LIST COMMENCES AT HEAD CHUTES FOR ALL (4) MINE CONVEYORS.

2. ITEM LIST TERMINATES FOR No1 & No 2 PRODUCTS AT SKIRT PLATES FOR CONVEYORS TO BLENDING PILES & RECLAIM/BYPASS (ADJACENT BLENDING PILES

3. ITEM LIST TERMINATES AT SKIRT PLATES FOR OVERLAND WASTE CONVRS TO DISPOSAL.

4. ALLOW A PROVISIONAL $100,000 IN WRITE UP TO INCLUDE FOR ANY POSSIBLE DUST SUPPRESION REQUIREMENTS IN SCREEN & CRUSH HOUSES (PER W.H.L)

5. FUTURE WASTE BELTS NOT ITEMISED

6. HEATING:— ALLOWANCE SHOULD BE MADE FOR HEATING. BINS, TRANSFER HOUSES ETC. (NOT CONVEYOR GALLERIES) BASED ON 6 BTU'S/HR PER CU.FT OF BUILDING VOLUME.

7. NO ALLOWANCE IN ITEM LIST FOR MECHANICAL OPERATION OF CHANGE OVER GATES (PRIME MOVER ETC) IN TWO WAY CHUTES

SHEET 2.

8. RE ITEM 7. IF ACTUATORS ARE USED FOR CHANGE OVER GATES, ALLOW IN ITEM LIST TO INCLUDE ELECTRICS

9 NOTE THAT DRIVE FOR ROTATING CHUTE ITEM 3354 HAS TO BE REVERSING.

* ELECTRICS

ESTIMATE

SIMON-CARVES OF CANADA LTD.
2025 Sheppard Avenue East
Willowdale, Ontario M2J 1W2

CLIENT: B.C. HYDRO
PROJECT: HAT CREEK
LOCATION:

DESCRIPTION: THIS ITEM LIST STARTS WITH HEAD CHUTES FOR 4 CONVEYORS FROM MINE.

PROJECT NO. F 1490

EST'D: DATE: AUG. 7th 1978

SHEET 1 OF

	ITEM	UNIT	QTY.	UNIT COST	UNIT M/H	TOTAL COST: EQUIPMENT	MATERIAL	FRT./DUTY	LABOUR	SUB/CONT.	TOTAL
3201	HEAD CHUTE FOR NORMAL COAL CONVR. FROM MINE, INCL. SKIRT PLATES		1 11060#				9955		6635		16590
* 3202	NORMAL COAL CONVR FROM DRIVE & TRANSFER HOUSE TO NORMAL COAL SURGE BINS	54" x	1 330' x	450/ft 450 HP.		148500			40,000		188500
3203	HEAD CHUTE FOR ABOVE CONVR		1 6680#				6010		4000		10010
* 3204	ROTATING DISTRIBUTION CHUTE FOR ABOVE CONVR FEEDING NORMAL COAL SURGE BINS (4 COMPTS)	PLUS:	10 HP. 1 6160#	REV.	DRIVE	1200	5545		3700 400		10845
3205	NORMAL COAL SURGE BINS, 4 COMPARTMENT 4 OUTLETS		1			INCL. WITH STRUCT. STEEL					
						149700	21510	5140	54735		[illegible]

571/ft

ESTIMATE SIMON-CARVES OF CANADA LTD. 2025 Sheppard Avenue East Willowdale, Ontario M2J 1W2	CLIENT PROJECT LOCATION	DESCRIPTION EST'D DATE	PROJECT NO. SHEET 2 OF

	ITEM	UNIT	QTY.	UNIT COST	UNIT M/H	EQUIPMENT	MATERIAL	FRT./DUTY	LABOUR	SUB/CONT.	TOTAL
						TOTAL COST					
3206 3207 3208 3209	BIN OUTLET CHUTE TO PLATE BELT FEEDER INCL. FEEDER SKIRT PLATES & DISCHARGE CHUTE		1 1 1 1	14950#			13,480		8990		22470
* 3210 * 3211 * 3212 * 3213	PLATE BELT FEEDER FOR NORMAL COAL		1 1 1 1			280,000			80,000		360,000
* 3214 * 3215 * 3216 * 3217	NORMAL COAL CONVR FROM BINS TO SCREEN & CRUSH HOUSE		1-54"x 1-54"x 1-54"x 1-54"x	450'x 382'x 382'x 450'x	200HP 200 HP 200 HP. 200 HP.	202500 171,900 171,900 202500			200,000		948800
3218 3219 3220 3221	SKIRT PLATES FOR ABOVE CONVR		1 1 1 1	14780#			13300		8870		22170
3222 3223 3224 3225	HEAD CHUTE FOR ABOVE CONVR		1 1 1 1	20180#			18160		12110		30270
						1028800	44910	32200	309970		1415910

2234

ESTIMATE SIMON-CARVES OF CANADA LTD. 2025 Sheppard Avenue East Willowdale, Ontario M2J 1W2	CLIENT PROJECT LOCATION	DESCRIPTION EST'D DATE	PROJECT NO. SHEET 3 OF

	ITEM	UNIT	QTY.	UNIT COST	UNIT M/H	TOTAL COST: EQUIPMENT	MATERIAL	FRT./DUTY	LABOUR	SUB/CONT.	TOTAL
* 3226 * 3227 * 3228 * 3229	NORMAL COAL SIZING SCREEN {1 SCREENING DECK FITTED ETM CARRYING DECK}		1 1 1 1			142000 4800			29000 1400		177,200
3230 3231 3232 3233	SUPPORT FOR ABOVE SCREEN		1 1 1 1			INCL. WITH STRUCT. STEEL					
3234 3235 3236 3237	DRIVE SUPPORT FOR ABOVE SCREEN		1 1 1 1	10,000 *			9000		6000		15000.
3238 3239 3240 3241	SCREEN OVERSIZE CHUTE TO NORMAL COAL CRUSHER		1 1 1 1	15415 *			13870		9250		23120
* 3242 * 3243 * 3244 * 3245	NORMAL COAL CRUSHER HAZEMAG C-200K 1 - 250 HP x 1200 RPM		1 1 1 1	62000 14000		248000 56000			52000 14000		370.000
						450800	22870	14,250	111,650		599,570

ESTIMATE	CLIENT	DESCRIPTION	PROJECT NO.
SIMON-CARVES OF CANADA LTD. 2025 Sheppard Avenue East Willowdale, Ontario M2J 1W2	PROJECT		
	LOCATION	EST'D DATE	SHEET 4 OF

	ITEM	UNIT	QTY.	UNIT COST	UNIT M/H	EQUIPMENT	MATERIAL	FRT./DUTY	LABOUR	SUB/CONT.	TOTAL
						TOTAL COST					
3246 3247 3248 3249	NORMAL COAL CRUSHER BASEPLATE		1 (×4)	16000#			14400		9600		24000
3250 3251 3252 3253	NORMAL COAL CRUSHER DRIVE BASEPLATE		1 (×4)	8400#			7560		5040		12600
3254 3255 3256 3257	NORMAL COAL CRUSHER TWO WAY DISCHARGE CHUTE TO NOS 1 & 2 PRODUCT CONVRS. C/W GATE.		1 (×4)	46675#			42000		28000		70000
3258 3259 3260 3261	NORMAL COAL SIZING SCREEN UNDERSIZE CHUTE TO BULK DENSITY ASH METER INCL. [illegible] SECTION		1 (×4)	36180#			32560		21700		54260
* 3266 3267 3268 3269	BULK DENSITY ASH METER TWO WAY DISCHARGE CHUTE TO NOS 1 & 2 PRODUCT CONVRS. C/W GATE.		1 (×4)	23480#			21130		14090		35220
							117650	3530	78430		199610

ESTIMATE SIMON-CARVES OF CANADA LTD. 2025 Sheppard Avenue East Willowdale, Ontario M2J 1W2	CLIENT PROJECT LOCATION	DESCRIPTION EST'D DATE	PROJECT NO. SHEET 5 OF

	ITEM	UNIT	QTY.	UNIT COST	UNIT M/H	EQUIPMENT	MATERIAL	FRT./DUTY	LABOUR	SUB/CONT.	TOTAL	
* 3270	No1. PRODUCT CONVR FROM SCREEN & CRUSH HOUSE TO TRANSFER HOUSE.		1-54"x 1	283'x	250HP.	127300			34,400		161,700	572
3271	HEAD CHUTE C/W SKIRT PLATES FOR ABOVE CONVR.		1	11060#			9950		6640		16590	
* 3272	No2 PRODUCTS CONVR FROM SCREEN & CRUSH HOUSES TO TRANSFER HOUSE		1-54"x 1	370'x	250HP	166000			45000		211,000	572
3273	HEAD CHUTE C/W SKIRT PLATES FOR ABOVE CONVR.		1	11060#			9950		6640		16590	
* 3274	No 1 PRODUCTS CONVR FROM TRANSFER HOUSE TO SAMPLING HOUSE		1-54"x 1	416'x	350HP.	187,000			50,000		237,000	572
						480300	19,900	15,000	142,680		657,880	

ESTIMATE	CLIENT	DESCRIPTION	PROJECT NO.
SIMON-CARVES OF CANADA LTD. 2025 Sheppard Avenue East Willowdale, Ontario M2J 1W2	PROJECT		
	LOCATION	EST'D DATE	SHEET 6 OF

	ITEM	UNIT	QTY.	UNIT COST	UNIT M/H	EQUIPMENT	MATERIAL	FRT./DUTY	LABOUR	SUB/CONT.	TOTAL
3275	HEAD CHUTE FOR ABOVE CONVR		1 11060#				9950		6640		16590
* 3276	No 2 PRODUCTS CONVR FROM TRANSFER HOUSE TO SAMPLING HOUSE	1 - 54" x 415' x 350 HP	1			187,000			50000		237,000
3277	HEAD CHUTE FOR ABOVE CONVR		1 11960#				9950		6640		16590
3278	SKIRT PLATES FOR No1 PRODUCTS CONVR IN SCREEN & CRUSH HOUSE		740# 1				670		440		1110
3279	SKIRT PLATES FOR No2 PRODUCTS CONVR IN SCREEN & CRUSH HOUSE		740# 1				670		440		1110
						187,000	21,240	6250	64,160		278,650

571

ESTIMATE	CLIENT	DESCRIPTION	PROJECT NO.
SIMON-CARVES OF CANADA LTD. 2025 Sheppard Avenue East Willowdale, Ontario M2J 1W2	PROJECT LOCATION	EST'D DATE	SHEET 7 OF

	ITEM	UNIT	QTY.	UNIT COST	UNIT M/H	EQUIPMENT	MATERIAL	FRT./DUTY	LABOUR	SUB/CONT.	TOTAL
						TOTAL COST					
* 3262 * 3263 * 3264 * 3265	BULK DENSITY ASH METER [illegible] (… 4)		1 1 1 1			176,800 4 × 3HP			4800		181,600
* 3280	No 1. PRODUCTS CONVR FROM SAMPLING HOUSE TO TRANSFER HOUSE TO BLENDING PILES		1-54" × 615' × 700HP 1			277000			75000		352,000 572
3281	SKIRT PLATES FOR ABOVE CONVR		740# 1				670		440		1110
3282	HEAD CHUTE FOR ABOVE CONVR. TWO WAY INCL. GATE		10050# 1				9040		6030		15070
* 3283	No 2 PRODUCTS CONVR FROM SAMPLING HOUSE TO TRANSFER HOUSE TO BLENDING PILES		1-54" × 600' × 700HP			270,000			73000		343,000 572
						723800	9710	22000	159270		914,780

ESTIMATE	CLIENT	DESCRIPTION	PROJECT NO.
SIMON-CARVES OF CANADA LTD. 2025 Sheppard Avenue East Willowdale, Ontario M2J 1W2	PROJECT		
	LOCATION	EST'D DATE	SHEET 8 OF

	ITEM	UNIT	QTY.	UNIT COST	UNIT M/H	EQUIPMENT	MATERIAL	FRT./DUTY	LABOUR	SUB/CONT.	TOTAL	
3284	SKIRT PLATES FOR ABOVE CONVR		740# 1				670		440		1110	
3285	HEAD CHUTE FOR ABOVE CONVR. TWO WAY. INCL. GATE.		10050# 1				9040		6030		15070	
3286	COLLECTING BOXES & SKIRT PLATES FOR CONVR FROM TRANSFER HOUSE TO BLENDING PILES		7875# 1				7090		4720		11810	
3287	COLLECTING BOXES & SKIRT PLATES FOR CONVR FROM TRANSFER HOUSE TO ETTA RECLAIM		10370# 1				9330		6220		15550	
* 3288	NORMAL COAL BYPASS CONVR		1-54"x85'x150 HP 1			38,000			10300		48,300	568
						38,000	26130	1950	27710		93970	

ESTIMATE

SIMON-CARVES OF CANADA LTD.
2025 Sheppard Avenue East
Willowdale, Ontario M2J 1W2

CLIENT

PROJECT

LOCATION

DESCRIPTION

PROJECT NO.

EST'D

DATE

SHEET 3 OF

	ITEM	UNIT	QTY.	UNIT COST	UNIT M/H	TOTAL COST: EQUIPMENT	MATERIAL	FRT./DUTY	LABOUR	SUB/CONT.	TOTAL
3089	HEAD CHUTE FOR ABOVE CONVR. INCL. SKIRT PLATES		11060# 1				9950		6640		16590
*** (TWO) (TRAVEL) (...) 3090	OVERHEAD TRAVELLING SERVICE CRANE, INCL ELECTRIC LIFTING HOIST. FOR SERVICING	20T x 48' SPAN x 100' LIFT EST.	1			80,000 20HP o.a.			16000		96,000
	BOTH SCREEN & CRUSH HOUSES. (To Suit Crusher	(20T?)									
* 3091	8T ELECTRIC HOIST FOR DRIVE & TRANSFER HOUSE FOR MINE CONVRS		1			15000 20HP o.a.			2000.		17000.
3092	5T HOIST BLOCKS		16	$4000		64,000			16000		80000
						159000	9950	5100	40640		214690

ESTIMATE

SIMON-CARVES OF CANADA LTD.
2025 Sheppard Avenue East
Willowdale, Ontario M2J 1W2

CLIENT

PROJECT

LOCATION

DESCRIPTION

PROJECT NO.

EST'D DATE

SHEET 10 OF

	ITEM	UNIT	QTY.	UNIT COST	UNIT M/H	EQUIPMENT	MATERIAL	FRT./DUTY	LABOUR	SUB/CONT.	TOTAL
	[illegible] FOR [illegible]					100,000 30HP TOTAL		3000	14000		117,000
						100,000		3000	14000		117,000

ESTIMATE SIMON-CARVES OF CANADA LTD. 2025 Sheppard Avenue East Willowdale, Ontario M2J 1W2	CLIENT PROJECT LOCATION	DESCRIPTION EST'D DATE	PROJECT NO. SHEET 11 OF

	ITEM	UNIT	QTY.	UNIT COST	UNIT M/H	TOTAL COST: EQUIPMENT	MATERIAL	FRT./DUTY	LABOUR	SUB/CONT.	TOTAL

ESTIMATE

SIMON-CARVES OF CANADA LTD.
2025 Sheppard Avenue East
Willowdale, Ontario M2J 1W2

CLIENT

PROJECT

LOCATION

DESCRIPTION

PROJECT NO.

EST'D DATE

SHEET 1C OF

	ITEM	UNIT	QTY.	UNIT COST	UNIT M/H	TOTAL COST					
						EQUIPMENT	MATERIAL	FRT./DUTY	LABOUR	SUB/CONT.	TOTAL

ESTIMATE SIMON-CARVES OF CANADA LTD. 2025 Sheppard Avenue East Willowdale, Ontario M2J 1W2	CLIENT B.C. HYDRO PROJECT HAT CREEK LOCATION	DESCRIPTION EST'D DATE	PROJECT NO. F 1490 SHEET 21 OF

	ITEM	UNIT	QTY.	UNIT COST	UNIT M/H	EQUIPMENT	MATERIAL	FRT./DUTY	LABOUR	SUB/CONT.	TOTAL	
3351	HEAD CHUTE FOR LOW GRADE COAL CONVR FROM MINE, TWO WAY. INCL. GATE & 2 SETS OF SKIRT PLATES.		1 12000#				10800		7200		18000	-
* 3352	LOW GRADE COAL CONVR. (STANDBY WASTE) FROM DRIVE & TRANSFER HOUSE TO LOW GRADE COAL/WASTE SURGE BINS.		1-54" 1	317' x	700HP	142600			38500		181100	571
3353	HEAD CHUTE FOR ABOVE CONVR.		6680# 1				6010		4010		10020	
* 3354	ROTATING DISTRIBUTION CHUTE FOR ABOVE CONVR FEEDING LOW GRADE COAL SURGE BINS (2 COMPTS) OR WASTE SURGE BINS (2 COMPTS)	PLUS	6160# 1 10HP	REV. DRIVE		1200	5540		3700 400		10840	
3355	LOW GRADE COAL & WASTE SURGE BINS. 4 COMPARTMENTS (2 FOR LOW GRADE COAL) (2 FOR WASTE)		1			INCL. WITH STRUCT. STEEL						
						143800	22350	5000	53810		224960	

ESTIMATE	CLIENT	DESCRIPTION	PROJECT NO.
SIMON-CARVES OF CANADA LTD. 2025 Sheppard Avenue East Willowdale, Ontario M2J 1W2	PROJECT		
	LOCATION	EST'D DATE	SHEET 22 OF

	ITEM	UNIT	QTY.	UNIT COST	UNIT M/H	EQUIPMENT	MATERIAL	FRT./DUTY	LABOUR	SUB/CONT.	TOTAL
3356 3357	BIN OUTLET CHUTE TO PLATE BELT FEEDER INCL FEEDER SKIRT PLATES & DISCHARGE CHUTE		1 1	7490#			6740		4490		11230
* 3358 * 3359	PLATE BELT FEEDER FOR LOW GRADE COAL REX.		1 1	70,000.		140,000			40,000		180,000.
* 3360 * 3361	LOW GRADE COAL CONVR FROM BINS TO SCREEN & CRUSH HOUSE		1-54" 1-54"	x 450' 382	x 200 HP x 200 HP	374,000			100,000		474,000
3362 3363	SKIRT PLATES FOR ABOVE CONVR.		7400# 1 1				6660		4440		11100
3364 3365	HEAD CHUTE FOR ABOVE CONVR.		10090# 1 1				9080		6050		15130
						514,000	22480	16100	154,950		707560

1401

ESTIMATE SIMON-CARVES OF CANADA LTD. 2025 Sheppard Avenue East Willowdale, Ontario M2J 1W2	CLIENT PROJECT LOCATION	DESCRIPTION EST'D	DATE	PROJECT NO. SHEET 21 OF

	ITEM	UNIT	QTY.	UNIT COST	UNIT M/H	EQUIPMENT	MATERIAL	FRT./DUTY	LABOUR	SUB/CONT.	TOTAL
* 3366 * 3367	LOW GRADE COAL SIZING SCREEN {2-SCREENING DECKS FITTED BTM CARRYING DECK}		1 1			95,000 2000			27,000 600		124,600
3368 3369	SUPPORT FOR ABOVE SCREEN		1 1			INCL	WITH	STRUCT	STEEL		
3370 3371	DRIVE SUPPORT FOR ABOVE SCREEN		5000# 1 1				4500		3000		7500
3372 3373	SCREEN OVERSIZE CHUTE TO LOW GRADE COAL CRUSHER		7710# 1 1				6940		4630		11570
* 3374 * 3375	LOW GRADE COAL CRUSHER 2-150HP x 1200		1 1			124,000 28,000			26,000 7000		185,000
						249000	11440	7800	68230		336470

ESTIMATE	CLIENT	DESCRIPTION	PROJECT NO.
SIMON-CARVES OF CANADA LTD. 2025 Sheppard Avenue East Willowdale, Ontario M2J 1W2	PROJECT		
	LOCATION	EST'D DATE	SHEET 21 OF

	ITEM	UNIT	QTY.	UNIT COST	UNIT M/H	EQUIPMENT	MATERIAL	FRT./DUTY	LABOUR	SUB/CONT.	TOTAL
3376 3377	LOW GRADE COAL CRUSHER BASE PLATE		8000# 1 1				7200		4800		12000
3378 3379	LOW GRADE COAL CRUSHER CONE BAFFPLATE		4200# 1 1				3780		2520		6300
3380 3381	LOW GRADE COAL CRUSHER, TWO WAY DISCHARGE CHUTE TO No 2 PRODUCT CONVR & REJECTS CONVR No.1 C/W GATE.		23340# 1 1				21010		14000		35010
3382 3383	LOW GRADE COAL SIZING SCREEN INTERMEDIATE SIZE CHUTE TO BULK DENSITY ASH METER INCL O/FLOW SECTION		18090# 1 1				16280		10850		27130
* 3384 * 3385	INTERMEDIATE SIZE BULK DENSITY ASH METER		1 1			88400			2400		90800
						88400	48270	4100	34570		175340

ESTIMATE

SIMON-CARVES OF CANADA LTD.
2025 Sheppard Avenue East
Willowdale, Ontario M2J 1W2

CLIENT

PROJECT

LOCATION

DESCRIPTION

PROJECT NO.

EST'D

DATE

SHEET 25 OF

	ITEM	UNIT	QTY.	UNIT COST	UNIT M/H	EQUIPMENT	MATERIAL	FRT./DUTY	LABOUR	SUB/CONT.	TOTAL
						TOTAL COST					
3386 3387	INTERMEDIATE SIZE BULK DENSITY ASH METER TWO WAY DISCHARGE CHUTE TO No 2 PRODUCTS CONVR & REJECTS CONVR No 1. C/W GATE		11740# 1 1				10570		7040		17610
3388 3389	LOW GRADE COAL SIZING SCREEN UNDERSIZE CHUTE TO BULK DENSITY ASH METER. INCL. O/FLOW SECTION		18090# 1 1				16280		10850		27130
* 3390 * 3391	UNDERSIZE BULK DENSITY ASH METER		1 1			88400			2400		90800
3392 3393	UNDERSIZE BULK DENSITY ASH METER TWO WAY DISCHARGE CHUTE TO No 2. PRODUCTS CONVR & REJECTS CONVR No 1. C/W GATE		11740# 1 1				10570		7040		17610
3394	SKIRT PLATES FOR REJECTS CONVR. No. 1		740# 1				670		440		1110
						88400	38090	3800	27770		158060

ESTIMATE

SIMON-CARVES OF CANADA LTD.
2025 Sheppard Avenue East
Willowdale, Ontario M2J 1W2

CLIENT	
PROJECT	
LOCATION	

DESCRIPTION	PROJECT NO.
EST'D	DATE
SHEET 26 OF	

	ITEM	UNIT	QTY.	UNIT COST	UNIT M/H	EQUIPMENT	MATERIAL	FRT./DUTY	LABOUR	SUB/CONT.	TOTAL
* 3395	REJECTS CONVR No 1	568 / A	1-54" x 1	250' x	100 HP	112,000			30,000		142000
3396	HEAD CHUTE & SKIRT PLATES FOR ABOVE		11050 1	#			9950		6640		16590
* 3397	REJECTS CONVR No.2	~~452~~ 572	1-54" x 1	620' x	125 HP	280,000			75000		355000
3398	HEAD CHUTE FOR ABOVE CONVR. TWO WAY. INCL. GATE & 2 SETS OF SKIRT PLATES		12000 1	#			10,800		7200		18000
						392000	20750	12400	118840		543990

ESTIMATE SIMON-CARVES OF CANADA LTD. 2025 Sheppard Avenue East Willowdale, Ontario M2J 1W2	CLIENT B.C. HYDRO PROJECT HAT CREEK LOCATION	DESCRIPTION EST'D DATE	PROJECT NO. F1490 SHEET 31 OF

	ITEM	UNIT	QTY.	UNIT COST	UNIT M/H	EQUIPMENT	MATERIAL	FRT./DUTY	LABOUR	SUB/CONT.	TOTAL
3451	HEAD CHUTE FOR WASTE CONVR FROM MINE INCL. SKIRT PLATES		11060 1				9950		6640		16590
* 3452	WASTE CONVR FROM DRIVE & TRANSFER HOUSE TO WASTE SURGE BINS		1-54"	315'	700 M	142,000			38,000		180,000
3453	BIFURCATED HEAD CHUTE FOR ABOVE CONVEYOR		10060# 1				9050		6040		15090
3454 3455	EMERGENCY WASTE BYPASS CHUTE TO TRUCKS. INC. GATE		12880# 1 1				11590		7730		19320
3456 3457	BIN OUTLET CHUTE TO PLATE BELT FEEDER. INCL FEEDER SKIRT PLATES & DISCHARGE CHUTE		7490# 1 1				6740		4490		11230
						142,000	37330	5400	62900		247630

571

ESTIMATE SIMON-CARVES OF CANADA LTD. 2025 Sheppard Avenue East Willowdale, Ontario M2J 1W2	CLIENT	DESCRIPTION	PROJECT NO.
	PROJECT		
	LOCATION	EST'D DATE	SHEET 22 OF

	ITEM	UNIT	QTY.	UNIT COST	UNIT M/H	EQUIPMENT	MATERIAL	FRT./DUTY	LABOUR	SUB/CONT.	TOTAL	
						TOTAL COST						
* 3458 * 3459	PLATE BELT FEEDER FOR WASTE REX.		1 1	70,000		140,000			40,000		180 000	
* 3460	WASTE CONVR FROM BIN TO BELT TAKE-UP & TRANSFER HOUSE		1-54" 1	250'x	300HP	112,000			30,000		142,000	568
3461	SKIRT PLATE FOR ABOVE CONVR		740# 1				670		440		1110	
3462	HEAD CHUTE FOR ABOVE CONVR. TWO WAY. INCL GATE & 2 SETS OF SKIRT PLATES		12000# 1				10800		7200		18000	
* 3463	WASTE CONVR FROM BELT TAKE-UP & TRANSFER HOUSE TO WASTE CONVRS JUNCTION HOUSE		1-54"x 1	513'x	450HP	230,000			62,000		292,000	569
						482000	11470	15000	139640		648110	

ESTIMATE	CLIENT	DESCRIPTION	PROJECT NO.
SIMON-CARVES OF CANADA LTD 2025 Sheppard Avenue East Willowdale, Ontario M2J 1W2	PROJECT		
	LOCATION	EST'D DATE	SHEET 33 OF

	ITEM	UNIT	QTY.	UNIT COST	UNIT M/H	EQUIPMENT	MATERIAL	FRT./DUTY	LABOUR	SUB/CONT.	TOTAL
						TOTAL COST					
3464	HEAD CHUTE FOR ABOVE CONVR. INCL. SKIRT PLATES		11060 # 1				9950		6640		16590
	HYDRAULIC DOOR ACTUATORS 3½" ⌀ x 1000 PSI		12	650		7800			1800		9600
	HYDRAULIC POWER PACK PER PAIR OF ACTUATORS		6	2600		15600			1500		17100
	ALL'CE. FOR DUST SUPPRESSION.									250,000	250,000
						23400	9950	1000	9940	250,000	294,290

ESTIMATE

SIMON-CARVES OF CANADA LTD.
2025 Sheppard Avenue East
Willowdale, Ontario M2J 1W2

CLIENT	B.C. HYDRO
PROJECT	HAT CREEK
LOCATION	

DESCRIPTION	PROJECT NO. F1450
EST'D	DATE
	SHEET 41 OF

	ITEM	UNIT	QTY.	UNIT COST	UNIT M/H	EQUIPMENT	MATERIAL	FRT./DUTY	LABOUR	SUB/CONT.	TOTAL
3475	HEAD CHUTE FOR WASTE CONVR CLAY FROM MINE. INCL. SKIRT PLATES.		11060# 1				9950		6640		16590
* 3476	WASTE CONVR CLAY FROM TRANSFER HOUSE TO WASTE CONVRS TRANSFER HOUSE		1-54" x 530' x 450HP. 1			238,000			64,000		302,000	570
3477	HEAD CHUTE FOR ABOVE CONVR. INCL SKIRT PLATES		11060#. 1				9950		6640		16590
						238000	19900	7740	77280		342920

ESTIMATE SIMON-CARVES OF CANADA LTD. 2025 Sheppard Avenue East Willowdale, Ontario M2J 1W2	CLIENT B.C. HYDRO PROJECT RAW COAL CRUSHING & HANDLING. LOCATION HAT CREEK B.C.	DESCRIPTION ELECTRICAL. EST'D J.M. DATE 21 AUG. 79	PROJECT NO. F1490 SHEET 1 OF 3

	ITEM	UNIT	QTY.	UNIT COST	UNIT M/H	TOTAL COST: EQUIPMENT	MATERIAL	FRT./DUTY	LABOUR	SUB/CONT.	TOTAL
1,	H.V. POWER DISTRIBUTION SYSTEM.						$325,500.00				
2,	CABLE TRAYS						$250,000.00				
3,	H.V. CABLES						$110,000.00				
4,	DUCT BANK						$7,500.00				
5,	COMMUNICATION SYSTEM						$50,000.00				
							$743,000.00				

ESTIMATE SIMON-CARVES OF CANADA LTD. 2025 Sheppard Avenue East Willowdale, Ontario M2J 1W2	CLIENT PROJECT LOCATION	DESCRIPTION EST'D DATE	PROJECT NO. F1490 SHEET 2 OF 3

	ITEM	UNIT	QTY.	UNIT COST	UNIT M/H	TOTAL COST: EQUIPMENT	MATERIAL	FRT./DUTY	LABOUR	SUB/CONT.	TOTAL
6,	600V POWER, CONTROL CABLES & CONNECTORS						$140,000.00				
7,	GROUNDING SYSTEM						$25,000.00				
8,	600V MOTOR CONTROL [illegible]RS						$80,000.00				
9,	[illegible] LIGHTING.						—		—		$65,000.00
10	CONV. GALL. LIGHTING.						—		—		$150,000.00
							$245,000.00				$215,000.00

ESTIMATE	CLIENT	DESCRIPTION	PROJECT NO. F1490
SIMON-CARVES OF CANADA LTD. 2025 Sheppard Avenue East Willowdale, Ontario M2J 1W2	PROJECT		
	LOCATION	EST'D DATE	SHEET 3 OF 3

	ITEM	UNIT	QTY.	UNIT COST	UNIT M/H	TOTAL COST: EQUIPMENT	MATERIAL	FRT./DUTY	LABOUR	SUB/CONT.	TOTAL
—	[illegible] #1						$743,000.00				
—	[illegible] #2						$245,000.00				$215,000.00
							$988,000.00		1,000,000		$215,000.00
							988000		1000000	215,000	2,203,000

APPENDIX VI

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