

K-SHELL LINE CREEK
HORSESHOE RIDGE

69(1)A

6901A

REPORT SUBMITTED IN SUPPORT OF
APPLICATION FOR RENTAL REBATE
PURSUANT TO SECTION 24(2) OF
THE COAL ACT

CONFIDENTIAL
OPEN FILE

COAL LICENCES 264 to 313 INCL.,
365 to 373 INCL., and 408

CROWS NEST INDUSTRIES LIMITED

GEOLOGICAL BRANCH
ASSESSMENT REPORT

Save on March 10, 1970

00 410

Fernie, British Columbia
Telephone: (604) 423-4464

CROWS NEST INDUSTRIES LIMITED

March 13, 1970.

J. J. Crabb
exploration manager



Mr. K. B. Blakey,
Deputy Minister of Mines,
Department of Mines & Petroleum Resources,
Victoria, B.C.

Dear Mr. Blakey:

We are pleased to submit the enclosed report concerning Coal Licences 264 to 313 incl., 365 to 373 incl., and 408, in support of our application for rental rebate pursuant to Sec. 24(2) of the Coal Act. R.S. 1948C209 S1.

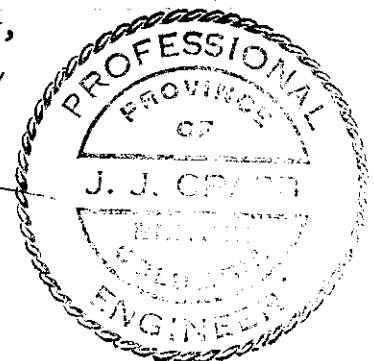
This report discusses the work performed and results obtained during the period March 1, 1969 to February 28, 1970.

Our Company is continuing its appraisal of the licence areas. Certain feasibility studies such as mine and plant design have already been initiated.

Our affidavit and summary of exploration costs are included in the introduction. Please note that the amount of money spent on investigation exceeds considerably the requirement of \$7.50 per acre to qualify for rebate. Would you kindly advise us if the excess may be applied to the succeeding term.

We hope you will treat this application favourably.

Yours very truly,



GENERAL OFFICES
FERNIE, B. C.

MINERALS DIVISION
FERNIE, B. C.

FOREST PRODUCTS DIVISION
MAIN OFFICE
FERNIE, B. C.

ELKO OPERATIONS
ELKO, B. C.

JJC/sb



THE GOVERNMENT OF
THE PROVINCE OF BRITISH COLUMBIA

DEPARTMENT OF MINES
AND PETROLEUM RESOURCES

MINERAL ACT

FORM B

Affidavit on Application for Certificate of Work

PURSUANT TO SEC. 24(2) COAL ACT R.S. 1948C209 S1

I, J.J. Crabb, Agent for Crows Nest Industries Limited,
(Name.) (Name.)

Box 718, Fernie,
(Address.) (Address.)

Fernie, B.C. B.C.

Free Miner's Certificate No. NA Free Miner's Certificate No. NA

Date issued NA Date issued NA

make oath and say:—

I have done, or caused to be done, work on the COAL LICENCES 264 to 313 incl.,
365 to 373 incl., and 408. Mineral Claim(s)

Record No.(s) _____

situate at Line Creek - Tributary of Fording River D.L. 4588 K.D.

in the Ft. Steele Mining Division, to the value of at least

600,978.58
~~one hundred dollars~~, since the 1st day of March, 1969.

The following is a detailed statement of such work:—

(Set out full particulars of the work done in the twelve months in which such work is required to be done.)

See Attached Statement as Exhibit "A" to
this my affidavit

That I have not and will not use the work declared herein in any way for the purposes of obtaining tax exemption on a Crown-granted mineral claim under the terms of the *Taxation Act*.

SWORN and subscribed to at Fernie
this 13 day of March
1970, before me—
H.A. Swain
A Commissioner for taking Affidavits within BC

* This affidavit may be taken by a person empowered to take affidavits by the Evidence Act of British Columbia.

EXPLORATION EXPENSE DETAIL

MARCH 1, 1969 TO FEBRUARY 28, 1970

TORNADO MTN.

COAL LICENCES 264 to 313 INCL.,
365 to 373 INCL., and 408

BULLDOZING	\$ 25,657.27
ADIT WORK	\$ 81,506.92
CONTRACT DRILLING	\$276,924.38
SAMPLING AND TESTING	\$ 6,021.75
AERIAL PHOTOGRAPHY	\$ 1,603.83
SUPERVISION & ENGINEERING	\$ 38,553.19
SNOW REMOVAL	\$ 17,485.13
MISCELLANEOUS	\$ 10,502.65
ROAD CONSTRUCTION	\$ 48,789.41
TEST PIT EXCAVATION	\$ 65,963.20
PLASTIC MODEL	\$ 1,890.14
ASSAY LAB	\$ 26,080.71
	<hr/>
	\$600,978.58
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~~#~~
 ✓ This is exhibit "A" referred
 to in the affidavit of J.J. Crabb
 sworn before me this 13th day
 of March 1970 ✓HS

Hugh Swaney
 A Commissioner for Taking Affidavits
 within British Columbia

PERIOD COVERED

The period covered is from March 1, 1969 to February 28, 1970. The previous report covering the same area was for March 1, 1968 to February 28, 1969. Although the licences are in three separate blocks they are treated as being one unit, as was done for the preceding period.

The renewal dates for the unit are March 13th, 1970, July 11th, 1970 and August 17th, 1970. The reporting period is designed to accommodate the bulk of the licences which fall due on the earlier date.

Exploration work was continuous during the period with no break during the winter season.

AREAS OF INVESTIGATION

Detailed field work was concentrated in three areas:

Line Creek Ridge, Crown Mountain and, Horseshoe Ridge. For locations please refer to Plate I, (Photomosaic of Upper Elk Area) in pocket.

Work performed on Line Creek Ridge and Horseshoe Ridge was essentially a continuation of the study initiated during the previous year. Most of the exploration work done on Crown Mountain was new.

Other portions of the licence area were covered by reconnaissance only.

*Horseshoe Ridge }
Line Creek Ridge } Lic Nos 277-304; 368-370; 373
Crown Mountain } Lic Nos. 305-313; 365-367; 371-372; 408*

WORK PERFORMED

1. LINE CREEK RIDGE - Refer to Plate II (Photo Enlargement) and Plate III (Topographic Map of Line Creek Area, Scale 1" : 400').

Bulldozing

An average of two machines, one D8H and one D9G were used for road building, test pits, drill sites, seam tracing and trenching, etc. These are equipped with hydraulic ripper bars used to reduce the amount of rock drilling and blasting. Smaller "cats" have been used from time to time for lighter work.

A summary of work appears at the end of this section.

Adit Work

Adits and/or test pits are essential for quality determinations that involve large quantities of coal not otherwise obtainable. These entries usually have gross dimensions of six feet by eight feet (width and height respectively). Where possible they are driven on the floor at a gradient of 1 or 2 degrees, almost along strike. One or more raises or crosscut up to the roof are made for sampling. This provides good drainage and the entry is available for later resampling. Various methods of handling coal are used. The one preferred by C.N.I. employs an air driven pan shaker conveyor. The same compressor supplies air for drilling and ventilation, making a compact package.

Crews consist of three men; one fireboss and two miners. For distances up to 100 feet the above methods usually advance an average of about eight feet per 7 hour on-site shift. This will decrease as the length increases.

Five new coal entries were started during the reporting period using two - 3 man crews. Generally speaking these have not been successful in obtaining unoxidized coal samples, due to the nature of the prospect; viz. Line Creek Ridge is basically a synclinal strike ridge with rather steep dips on both limbs, especially along the west flank. On the latter side it was necessary to install electric chains and go down partial dip at maximum angles less than 25 degrees. As a

ADIT WORK SUMMARY

ADIT NO.	SEAM NO.	STARTING DATE	FINISHING DATE	ENTRY DISTANCE	CROSS CUTS	COMPLETED	MAN DAYS	
1	8 HSR	May 2, 1968	June 4, 1968	110'	None	No ✓	28	
2	7 HSR	June 5/68 Sept. 30/70	June 7, 1968 Nov. 9, 1970	25' 218'		No Yes - Sample to Ottawa	6 68	
3	8 LCR	July 16/68 Sept. 9/68	Aug. 16/68 Oct. 21/68	110' 305'	178'	305'	No Yes - Oxidized	61 65
4	9	Aug. 19/68 Mar. 10/69	Aug. 27/68 May 14/69	45' 360'	100'	345'	No Yes - Sample to Ottawa	21 131
5	10B	Aug. 28/68 Jan. 29/70	Sept. 5/68 Feb. 24/70 ✓	40' 156'		156'	No Yes - Sample to Ottawa	9 51
6	10A	Sept. 6/68 Feb. 25/70	Sept. 6/68 May 27/70	Collared 443'		443'	No Yes - Oxidized	3 175
7	8	Oct. 28/68 Jan. 1/69	Dec. 31/68 Mar. 7/69	380'	300'	375'	Yes - Partially Oxidized Sample To Ottawa	82 103
8	8	May 20/69	Sept. 11/69	340'	200'	335'	Yes - Oxidized	220
9	9	June 20/69	Oct. 20/69	375'		356'	Yes - Oxidized	214

ADIT WORK SUMMARY
 11/17/70
 J. J. J.

ADIT NO.	SEAM NO.	STARTING DATE	FINISHING DATE	ENTRY DISTANCE	CROSS	CUTS	COMPLETED	MAN DAYS
10	10B	Sept. 25/69	Jan. 27/70	305'		305'	Yes - Sample To Ottawa	139
11	10A	Oct. 27/69	Apr. 22/70	394'		394'	Yes - Oxidized	266.5
12	10A	May 28/70	July 3/70	339'		339'	Yes - Sample To Ottawa	149
13	7 HSR	May 4/70	May 26/70	104'	48'	100'	Yes - Sample To Ottawa	45
14	8 HSR	May 24/70	Sept. 24/70	148'		84'	Yes - Sample To Ottawa	102
15	6 LCR	Aug. 12/70	Sept. 8/70	121'	71'	121'	Yes - Sample To Ottawa	55
16	7 LCR	Sept. 11/70	Dec. 2/70	295'	186'	272'	Yes - Sample To Ottawa	127
17	2 LCR	Nov. 11/70	Jan. 7/71	150'			No	55

Adit Work (Con't)

result, instead of advancing at right angles to the outcrop, the entries must advance at an acute angle to the strike. In an entry distance of say 350 feet, the face is therefore still less than about 150 feet perpendicular slope distance from the outcrop; in some cases still in the zone of oxidation.

Since this type of equipment is more sophisticated and pitch work is difficult, adits numbered 8, 9, 10, and 11 have been costly and time consuming.

Adits numbered 3, 4, 5, 6 and 7 on the east side are strike entries.

At this writing adits 6 and 11 are still advancing. Bulk samples have been taken from Nos. 4, 7, 6 and 10 for washability studies and carbonization tests. The results of these are given later in the report.

Drilling

Thirty-eight 4-7/8 inch holes have been drilled on Line Creek Ridge. These have an average depth of 652 feet for a total length of 24,677 feet. Logs of 31 of these are included as Plates IV, V, and VI which are composite photographic reductions of Gamma Ray - Neutron logs. Superimposed are rock types and *proximate analysis of the coal samples.

The "Sure-Core" method of reverse circulation was used for maximum sample recovery and minimum contamination. Drill pipe is dual walled, the circulating medium (in most cases is air) travels down the annulus. Cuttings are swept from the bit teeth to the inside pipe and then to the surface where they are trapped in a cyclone. Rock chip samples are collected and logged every five feet. When a coal seam is encountered, a soft formation or an insert bit is tripped in to obtain a coarser coal sample. If the hole is wet, samples are collected in barrels. Sample percent recovery is determined by weighing the samples obtained and expressing this as a percentage of the theoretical weight. All samples are then washed before running a proximate analysis.

In spite of the fact that the drill pipe is a "skintight" fit (1/8" clearance) fewer holes are lost, (especially in bad ground) than using conventional rotary equipment. This is probably due largely to the fact that the circulating medium is

* Drill holes one to six are raw coal. All others have been washed. Numbers read left to right - moisture, volatile, ash and F.S.I.

Drilling (Con't)

not in contact with the hole wall, thereby preventing erosion of the weaker materials. Another reason may be because the side of the hole is supported by the drill pipe. In the case of Line Creek Ridge, most holes drilled through 4 or more seams of coal without difficulty.

The drill rig and pipe rack are both truck mounted for maximum mobility. A Geolograph is used to yield drilling breaks (top and bottom of coal seams) and, rock penetration rates. The latter are valuable if they can be translated into blasthole drilling costs. Following completion of the hole, it is then logged using the Gamma Ray - Neutron sonde. Together with the driller's log, a three-way check provides accurate drill hole data.

The foregoing logging devices have been used by C.N.I. since 1964 in other portions of the Crowsnest Coal Fields.

Topographic & Geologic Mapping

The entire coal licence area was flown by Sparton Air Services Limited in July 1968 and provided photography at 1" : 3000'. These were used for photo geologic interpretation and general reconnaissance mapping.

The Line Creek - Horseshoe Ridge area was selected for topographic mapping and was re flown shortly after to provide photos on a scale of 1" : 2000'. The contractor also supplied the necessary photogrammetric field control. An area of 13,744 acres was mapped on a scale of 1" : 200' with 10 foot contours. (Plate III is a photographic reduction to 1" : 400').

All drill holes, outcrop exposures, adits, trenches, etc., are tied in by means of transit and tape to the Sparton base control by C.N.I. survey personnel. Coal tonnage estimates and overburden quantities are calculated from cross-sections based upon the original mapping.

Most of the normal geologic mapping is done on photo enlargements and later transferred to the base maps to assist in structural interpretation.

The base maps are also used for preliminary mine design, selection of overburden sites, mine access roads, isopachs, depicting coal quality and, a number of other important uses necessary in feasibility studies.

Sampling and Testing

Crows Nest Industries maintains its own laboratory in Fernie. It is A.S.T.M. equipped to undertake proximate analysis, micro washability studies, sulphur determinations and calorific values. It is also equipped with coal washing apparatus to handle larger samples for sending out. All small samples from adits, drill holes, pits, etc., are assayed here. Bulk samples are checked and some washed before forwarding for the necessary washability, carbonization and, other technical tests.

Since July 1968 the company lab has processed about 2693 samples, roughly divided as follows: 1157 proximate, 1369 F.S.I., only 9 sulphur and 158 washed. During this reporting period it handled approximately 2000 such analyses.

In the adits, face channel samples up to five pounds each are taken every ten feet. Depending upon seam thickness, these are sometimes combined with auger samples from the coal roof. These are then analyzed variously in accordance with the desired information. Proximate analysis may be run on either the raw or cleaned coal. In most instances the item of prime concern is the F.S.I. (free swelling index). When this reaches a higher and constant level during adit advance, the seam is assumed to be beyond surface oxidation effects and ready for bulk sampling. Other criteria such as oxygen content, total Volatile content, plasticity, petrographic reflectance etc., are sometimes considered although these are usually not common during this stage

Sampling and Testing (Con't)

of exploration.

The depth or outer zone of oxidation is a function of several factors among which are: Lithologic nature of the overlying strata, proximity to faults, folds and associated fractures, relationship of the seam to the surface, geologic history, drainage, etc. In the case of Line Creek Ridge the zone of oxidation varies from about 100 feet to over 350 feet from the outcrop. This is higher than many areas in the district and is due to several unique features relating mostly to structure.

Except for No. 8 seam, which has a three foot parting, drill hole cuttings are usually combined into one composite sample, since this is the manner in which it will be mined. The cuttings are then washed at a constant SG (to remove extraneous materials) to a suitable ash level before running a proximate analysis. Results of drill hole analysis are rarely used for total quality determination but rather as a check on more reliable samples taken from adits or pits. Cored drill hole samples are sometimes used for washability tests but this is not practical for the reverse circulation drill because size consist is not in a practical range and also because the varying amounts of extraneous rock and clay cuttings mixed with the coal render yield values which are not valid. In some cases however, because of the lack of other quality control data drill samples must be relied upon but only for certain items such as F.S.I. and an indication of coal rank and other quality parameters. Occasionally, drill hole samples have been combined in blends of differing degrees of oxidation and sent to Ottawa for 30 lb. oven tests.

The present status of quality determination is as follows:

1. Washability Studies - Done by Commercial Testing and Engineering Co., Chicago. (Including screen analysis, tumbler and other physical and chemical tests).

a. Seam 8 (adit 7) and seam 9 (adit 4) - 5000 lb. each of raw coal crushed to -2".

- Results given in later section.

b. Seam 10B (adit 10) - similar sample as above. Results expected by March 16, 1970.

c. Seam 10A (adit 11 or adit 5) - sample expected to be sent for testing about March 23, 1970. Results back April 12th, 1970.

2. Technical Scale Tests - Department of Energy, Mines and Resources - Metals Reduction and Energy Centre.

a. Seam 8 (adit 7) and seam 9 (adit 4) 1000 lb. clean coal sample. Coal and carbonization tests completed - results given later.

b. Seam 8 (D.H. 41) 1000 lb. clean coal sample shipped February 16, 1970 part of carbonization tests received and given - coal testing still under further results expected March 18, 1970.

c. Seam 10B (adit 5) 1000 lb. clean coal - coal and coke testing underway - results of both expected by March 20, 1970.

d. Blend (approximately 100 lb. clean coal).

- 90% 10B seam D.H. 36 (FSI 6)
- 10% 8 seam D.H. 37 (FSI 1 $\frac{1}{2}$)

2. Technical Scale Tests (Con't)

- d. - sent January 29, 1970. Results expected by March 16, 1970.
- e. Blend (approximately 100 lb. clean coal)
 - 85% 9 seam D.H. 37 (FSI 6 $\frac{1}{2}$)
 - 15% 8 seam D.H. 37 (FSI 1 $\frac{1}{2}$)
 - sent January 29, 1970 - results expected by March 16, 1970.
- f. Seam 10B (approximately 100 lb. clean coal)
 - from D.H. 36 (FSI 6)
- g. Seam 10B (adit 10) (approximately 1000 lb. clean coal) Shipped March 11, 1970 from Commercial Testing in Chicago to Ottawa - results March 30, 1970.
- h. Seam 10A (approximately 40 lb. clean coal) from D.H. 41 and 42 - shipped February 16, 1970.
- i. Blend 8 seam D.H.'s 38 and 36 shipped February 16, 1970. (FSI 5 and FSI 3 respectively) 60% D.H. 38 and 40% D.H. 36.

Samples have also been sent to the Japanese:

<u>SEAM</u>	<u>LOCATION</u>	<u>WEIGHT</u>	<u>DATE SENT</u>	<u>REMARKS</u>
8	D.H. 38	5 lbs.	Feb. 15/70	Clean Coal)
9	D.H. 37	" "	Feb. 15/70	" ") No
10B	D.H. 37	" "	Feb. 15/70	" ") Results
10A	D.H. 41 & 42	" "	Feb. 13/70	" ")

2. CROWN MOUNTAIN

Bulldozing

About 7½ miles of main access road was built from the Company's logging road in Grave Creek Valley to the summit of the mountain. Three seams were trenched and traced along their outcrops. No test pits were attempted.

Drilling

The same drilling rig was used to drill eleven holes having an average depth of 495 feet. logs of these are shown on Plate VII.

Topographic and Geologic Mapping

Geologic mapping was done on photo enlargements. No topographic mapping has yet been undertaken. Work here was halted due to winter conditions and attention was redirected back to the Line Creek area.

Surveying of outcrops and drill holes will begin after the spring breakup.

Sampling and Testing

Coal sampling was restricted to drill hole cuttings. These were handled in the same fashion as the Line Creek Ridge samples. Results are shown on Plate VII.

3. HORSESHOE RIDGE

Bulldozing

Two D8H catapillar tractors were used to build a main access road along the west face. From this road, several others were cut into drill sites and to intersect seam outcrops.

Drilling

No drilling was done during the reporting period but the drill was moved into this area on Friday, March 6th, 1970.

Topographic and Geologic Mapping

Horseshoe Ridge was originally included in the Line Creek map area. Geologic mapping is done on 1" : 400' and cross sections compiled on the same scale.

W O R K S U M M A R Y

	<u>PERIOD</u>	<u>PERIOD</u>
	3/1/68 to 2/28/69	3/1/69 to 2/28/70
	-----	-----
MAIN ACCESS ROADS	9.5 Miles	16.4 Miles
MAIN ACCESS ROADS MAINTAINED	8.0 Miles	25 Miles
CAT TRENCHES & JEEP ROAD BUILT	11.5 Miles	7.2 Miles
ADITS COLLARED & READY TO START	3	5
ADITS COMPLETED	2	6
ADITS INCOMPLETE	2	4
TOTAL LENGTH OF ENTRIES DRIVEN	915'	1680'
TOTAL LENGTH OF CROSSCUTS	185'	280'
BULLDOZER TEST PITS	7	1
DRILL SITE PREPARED	8	45
AIR PHOTOGRAPHY	.210 Mi. ² @ 3000'	-
AIR PHOTOGRAPHY	44 Mi. ² @ 2000'	-
TOPOGRAPHIC MAPPING 1":200' - 10'Ct's	21.5 Mi. ²	-
DETAILED GEOLOGIC MAPPING	1.8 Mi. ²	3.5 Mi. ²
NUMBER OF DRILL HOLES		50
TOTAL LENGTH OF DRILL HOLES		30,148 Ft.

RESULTS

Coal Reserves

Exploration to date has been confined to the open pit potential of the licences. Several prospective areas for underground mining have been noted but little effort, as yet, has been made to investigate them.

Intensive work on Line Creek Ridge has proven the existence of 37.7 million short tons of raw delivered-to-plant open pit coal. The basis for the estimates follows on later pages. By the economics which prevail today, this means recoverable commercial coal. About 95 percent of this reserve lies within the bottom four seams of the Kootenay Formation. These are numbered 10A, 10B, 9 and 8 from bottom to top respectively.

A composite section derived largely from two deep holes indicate 16 seams of coal four feet or more in thickness. These aggregate 191 feet of coal within about 1500 feet of measures. Virtually none of these upper seams are included (as yet) in the above estimate. Reasonable projections indicate a further three to four million tons of "probable" coal yet to be placed in the proven category by further drilling.

On the basis of surface mapping of all natural and man-made exposures, Horseshoe Ridge is believed to contain a further 10.0 million tons on the same basis as used for calculating

Coal Reserves (con't)

the Line Creek Ridge tonnage. A glance at the mining and other losses used will confirm that these figures are conservatively estimated. Drilling is now in progress on Horseshoe Ridge to verify the "probable" estimate given above.

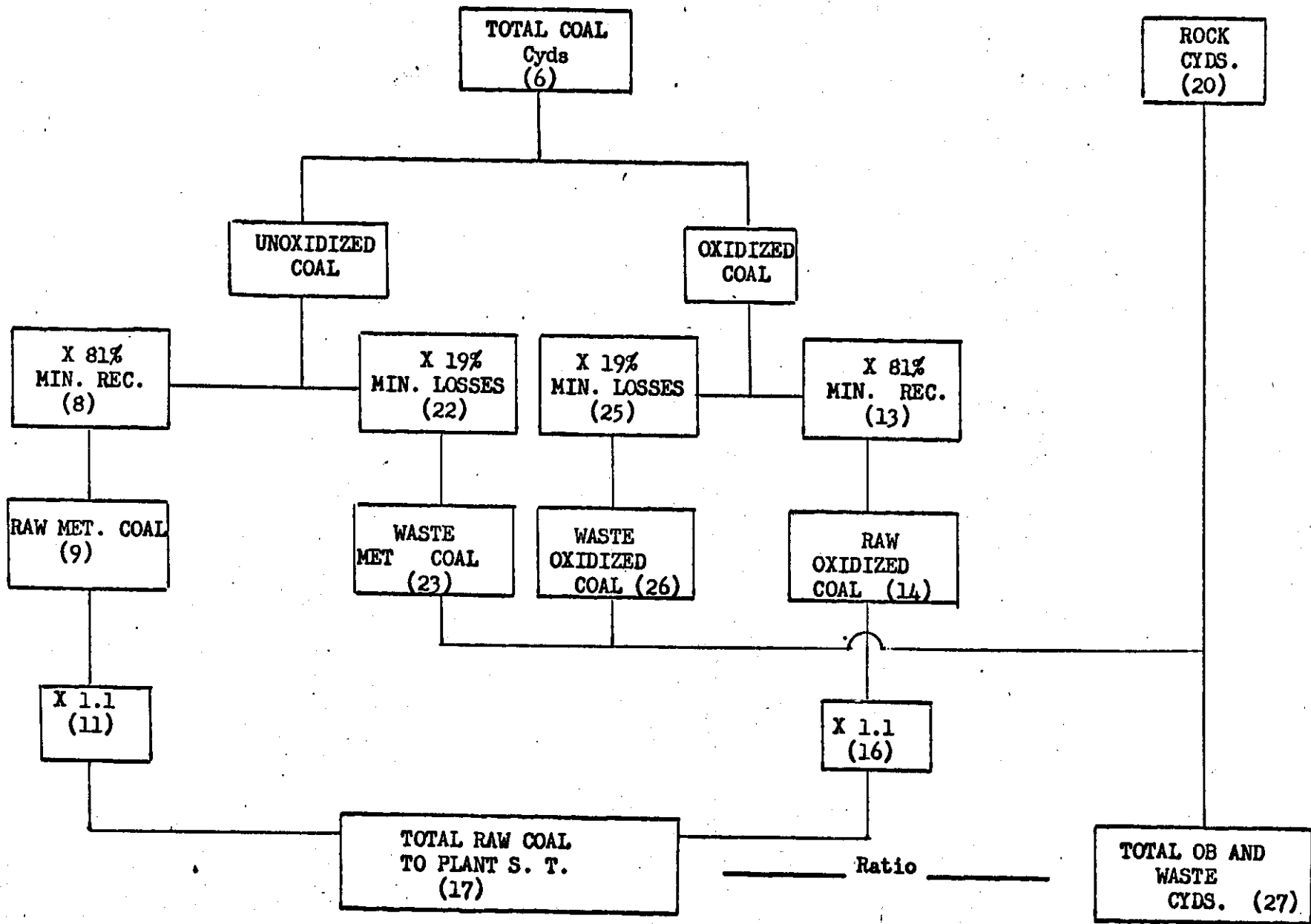
Eleven drill holes on Crown Mountain have also proven the existence of at least 3.0 million tons of open pit marketable coal and a possible further 3.5 million tons of non-coking coal which at the moment is non-economic per se.

Reconnaissance work has also suggested the possible existence of more open pit coal about 2 miles north of the Line Creek map area. An access road is currently being built into the area to effect a more detailed investigation. There are yet two or three other locations toward the north end of the property that warrant more work but time has not permitted further investigation.

COAL RESERVES

LINE CREEK RIDGE - Explanatory Notes

1. Coal tonnages, volumes of waste and, ratios of coal to waste were determined from 1" : 200' sections drawn every 500' using seam contours and a base plan of the same scale.
2. The cross-sectional seam lengths were measured in yards through the middle of each seam. The amount of oxidized coal was measured in the same manner and expressed as a percentage of the total coal.
3. Average seam thickness in the pit area were determined from stratigraphic measurements and drill hole intersections.
4. Waste areas were planimetered.
5. The method of calculations are shown by means of a "Flow Diagram".



RESERVE ESTIMATES

LINE CREEK RIDGE **

SUMMARY OF COAL TONNAGES, WASTE VOLUMES AND PIT RATIO AS OF FEBRUARY 1, 1970

SEAM	MET COAL S.T. (1)	OXIDIZED COAL S.T. (2)	TOTAL COAL S.T. (3)	TOTAL WASTE CYDS. (4)	RATIO (5)
10A	4,169,000	647,000	4,816,000	23,297,000	4.8
10B	6,216,000	853,000	7,069,000	30,772,000	4.4
9	7,290,000	1,034,000	8,324,000	74,920,000	9.0
8	10,903,000	2,902,000	13,806,000	96,690,000	7.0
7	1,871,000	635,000	2,505,000	7,934,000	3.2
6	764,000	353,000	1,117,000	5,481,000	4.9
4	-	85,000	85,000	80,000	0.9
Sub Total	31,213,000	6,509,000			
TOTAL			<u>37,722,000</u>	239,174,000	6.3

1. Raw coal delivered to plant calculated by reducing the "in place" reserve by 19% for mining losses, plus a further reduction for oxidized coal which averages 17.2% of the total coal.
2. Varying degrees of oxidation. Experiments have demonstrated that a large proportion can be blended back in without seriously affecting coke quality.
3. All coal will be loaded out.
4. Waste includes mining losses (19% of total coal).
5. Cubic yards of waste (including mining losses) per short ton (2000 lb.) of raw delivered coal.

** To section 57 & 250

QUALITY

General Comments

Like the Michel area and other portions of the Fernie Coal Basin, the volatile content increases stratigraphically upward. In Line Creek Ridge there appears to be about a nine percent volatile spread (A.S.T.M.) in 1500 feet of measures.

Since there is no physical connection of the Upper Elk Coal Fields with the Fernie Basin, correlation of seams is based upon the position in the section.

Seams 10A, 10B and 9 appear to lie within the same stratigraphic interval as the No. 10 seam (Balmer) at Michel. Without the benefit of a time correlation it is difficult to say which one would be the actual northeasterly extension of the No. 10 (Balmer) seam.

Tests run to date confirm that the proven coal reserve (essentially the bottom four seams) is borderline on the low to medium volatile (A.S.T.M.) range. Coke-making ability is as good as most other seams in southeastern B.C. The quality results which follow are:

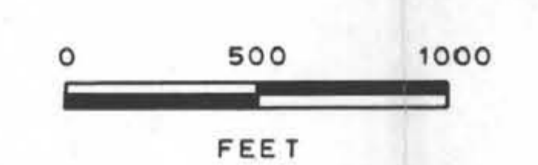
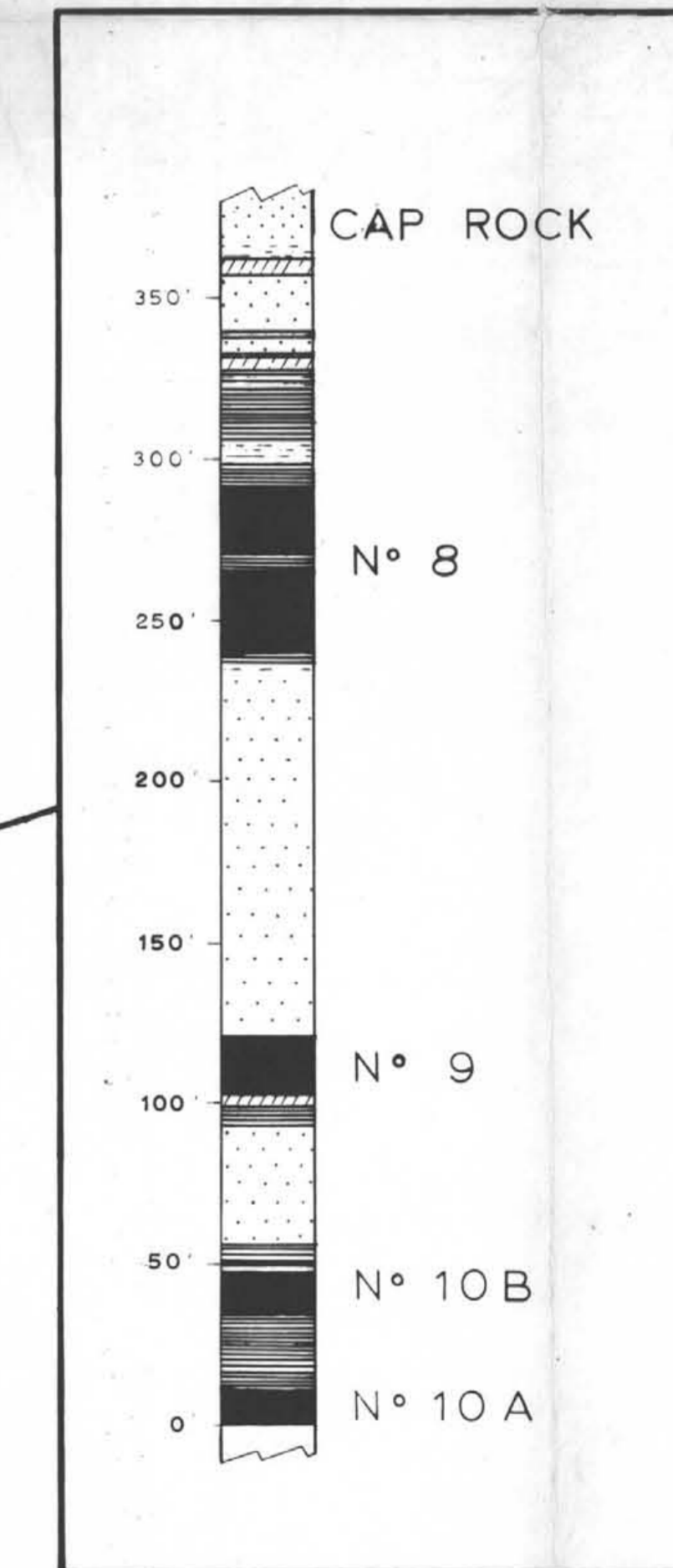
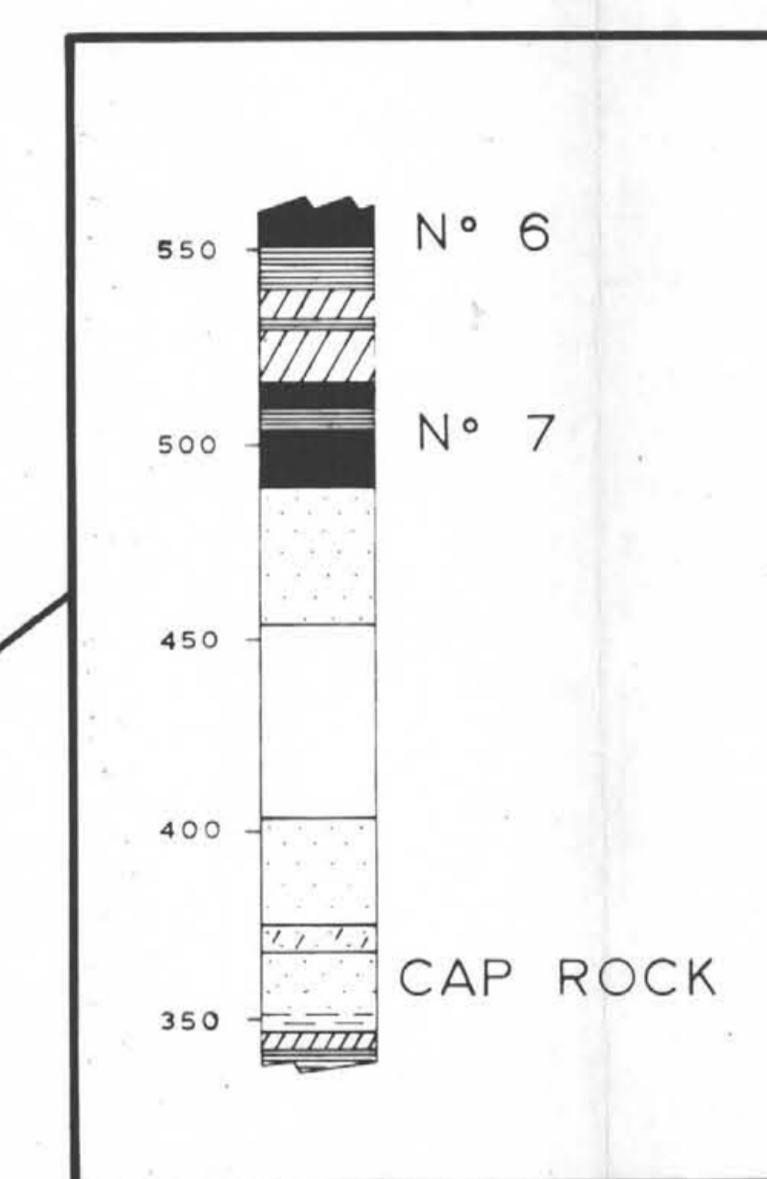
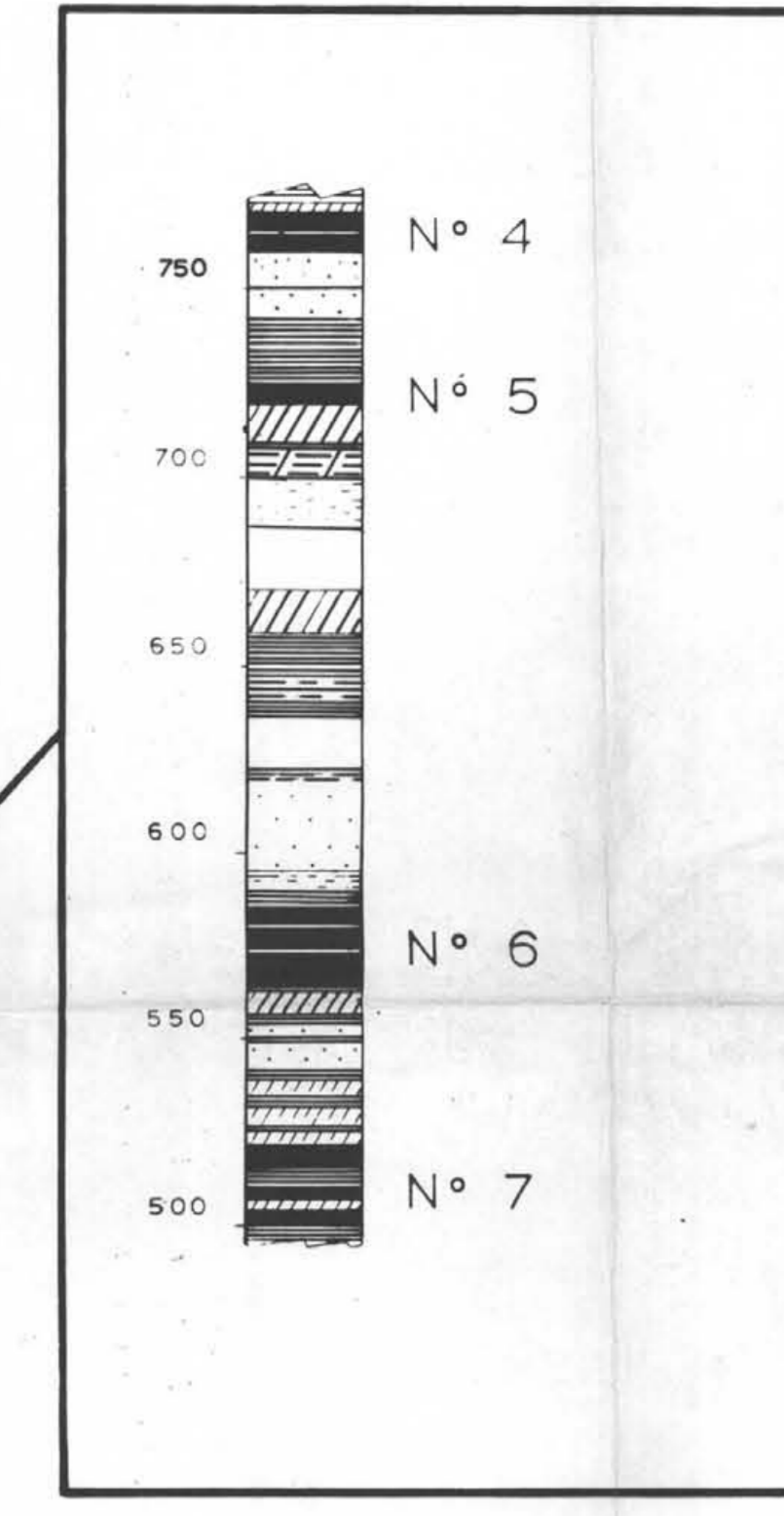
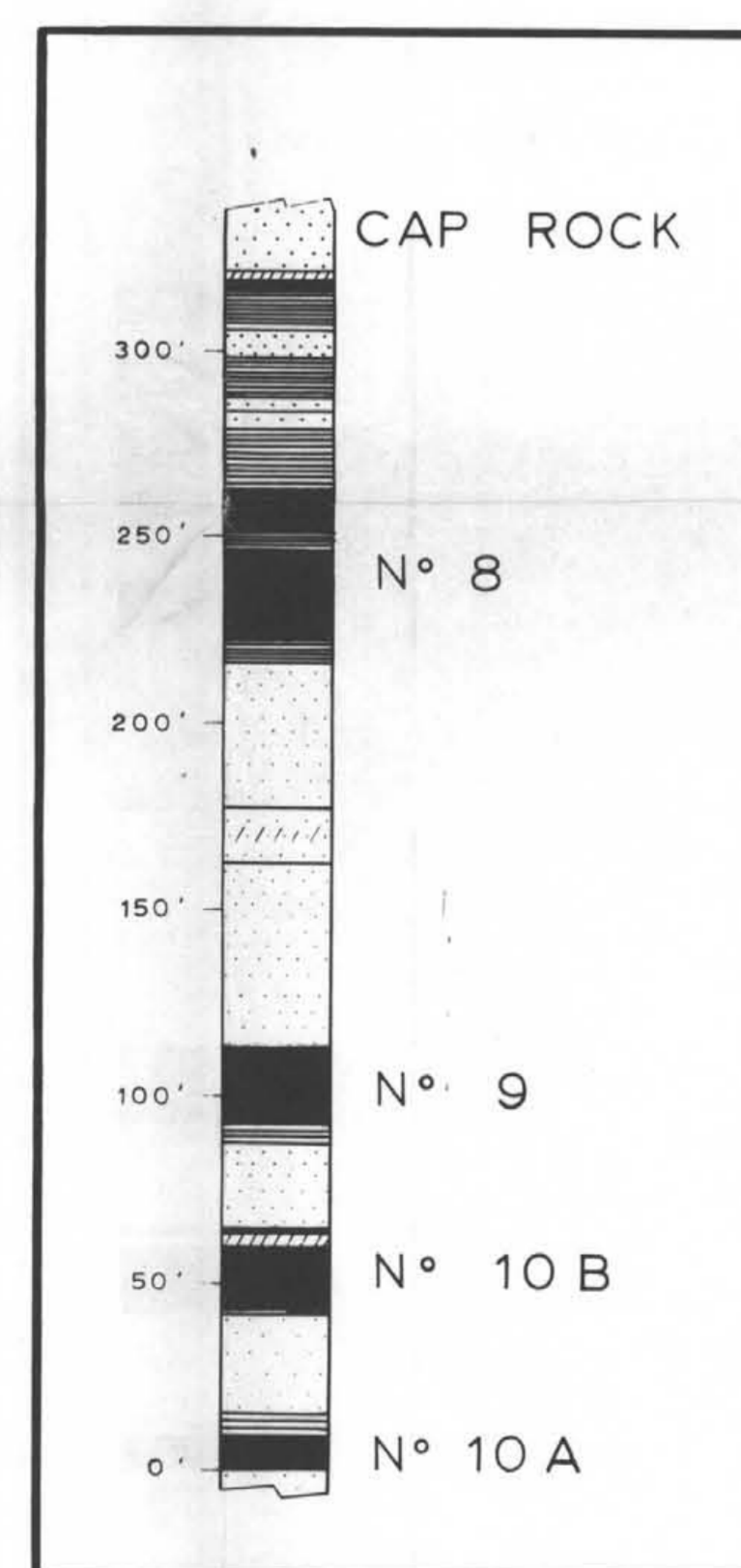
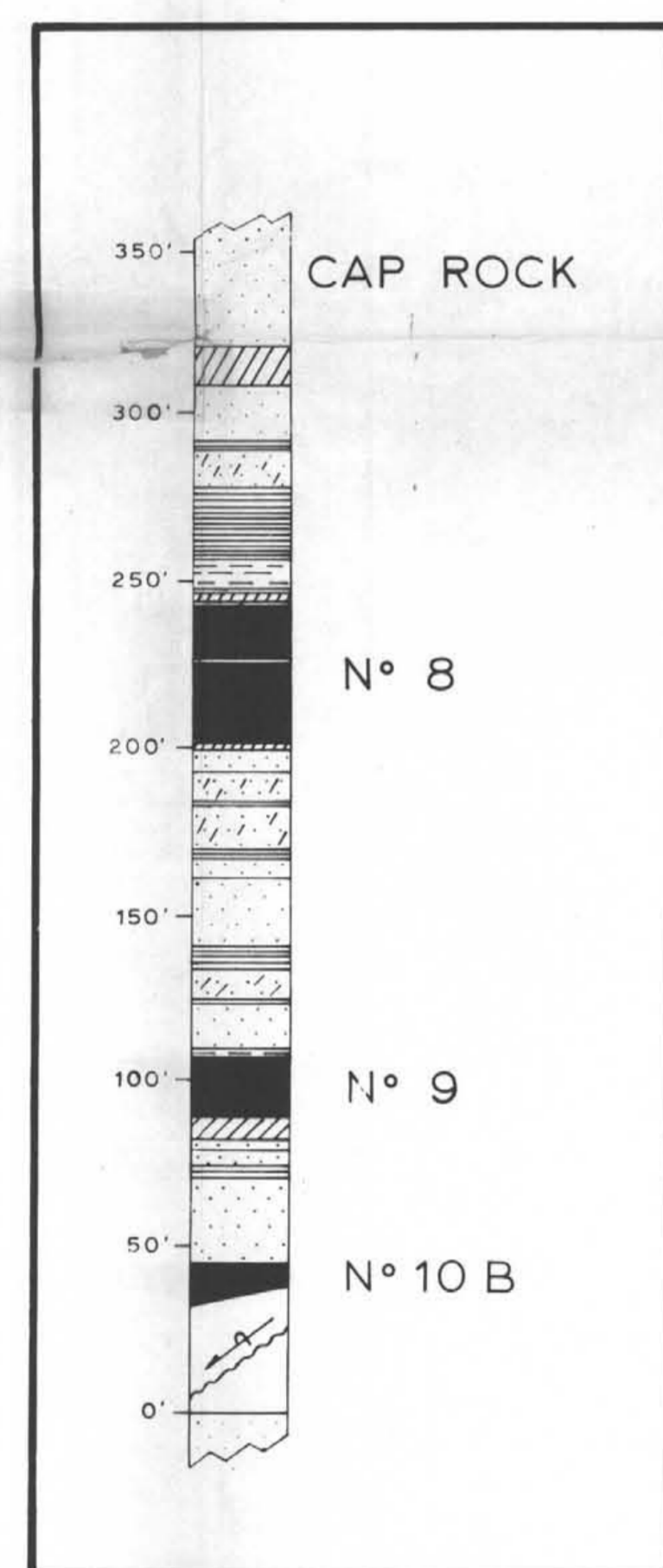
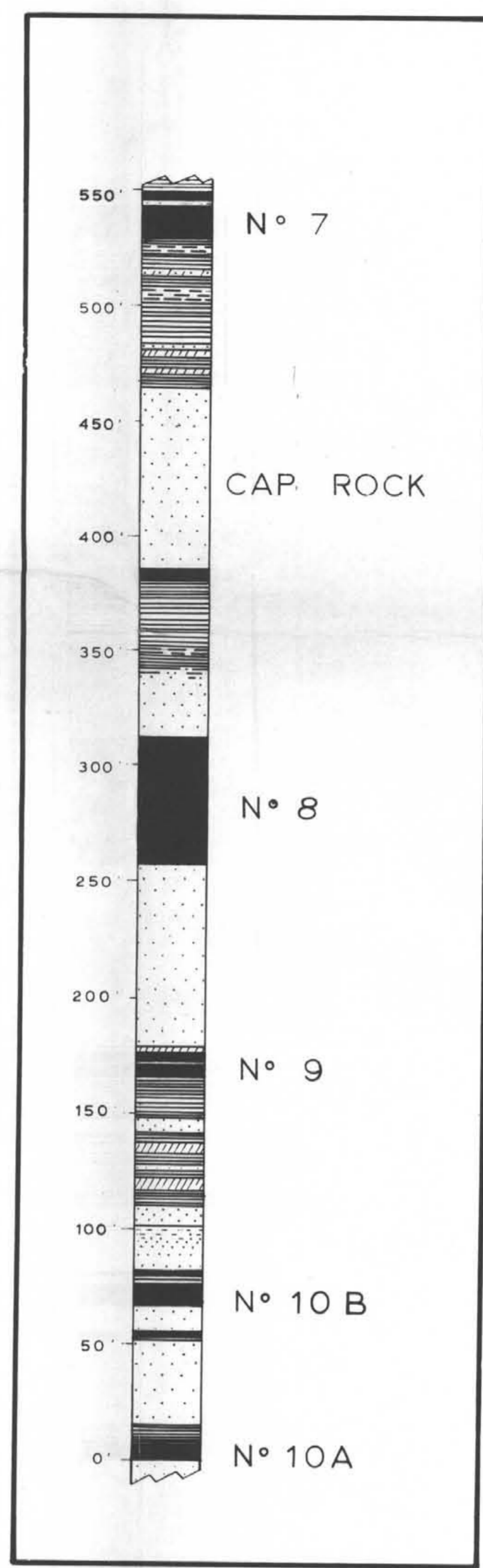
1. Commercial Testing and Engineering Co. - washability studies.
2. Data taken from results obtained by tests conducted by the Department of Energy, Mines and Resources, Ottawa.

K-SHELL LINE CREEK - HORSESHOE RD.
69(2)A

CONFIDENTIAL
OPEN FILE

**GEOLOGICAL BRANCH
ASSESSMENT REPORT**

00 410



LEGEND

	COAL
	CARBONACEOUS MATERIAL
	SHALE
	SILTSTONE
	SANDSTONE
	COVERED

CROWS NEST INDUSTRIES
LINE CREEK RIDGE

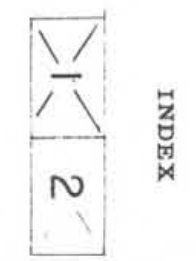
KEY

COAL SEAM OUTCROP (defined, approximate, assumed)	
FAULT (defined, assumed)	
THRUST	
BEDDING (inclined, overturned)	
FOLD AXIS & PLUNGE DIRECTION (defined, approximate)	
FOLD	
SYNCLINE	
ANTICLINE	
TEST PIT	
ADIT	

K-SHELL - LINE CREEK - HARRISBURG RIDGE (1912)

110

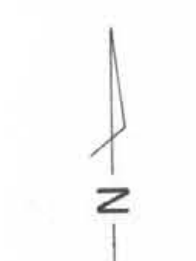
FORDING COAL LIMITED



FORDING COAL
PLANT SITE.

CROWNSNEST INDUSTRIES LIMITED
Scale 1" = 3000'

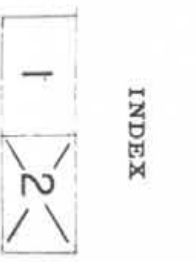
C.P.R. FORDING
RIVER SPUR LINE.



EWIN PASS.

110

LINE CREEK RIDGE.
HORSESHOE RIDGE.



KOOTENAY & ELK
RAILWAY.

CROWNSNEST INDUSTRIES LIMITED
Scale 1" = 3000'

CROWN MOUNTAIN.

HARMER RIDGE.

KAISER RESOURCES
PLANT SITE.



K-Shell-Line Creek-
Horseshoe Ridge
69(4)A

CONFIDENTIAL

410



Report of Results
of

Washability Investigations

for

Fernie No. 8 and Fernie No. 9 Seams

Crows Nest Industries Ltd.
Fernie, British Columbia

February 12, 1970



CONFIDENTIAL

COMMERCIAL TESTING & ENGINEERING CO.



CHICAGO, ILL. • CHARLESTON, W. VA. • CLARKSBURG, W. VA. • CLEVELAND, OHIO • TOLEDO, OHIO • NORFOLK, VA. • TERRE HAUTE, IND. • STRATTANVILLE, PA.

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Report of Results
of
Washability Investigations

for

Fernie No. 8 and Fernie No. 9 Seams
for

Crows Nest Industries Ltd.
Fernie, British Columbia

Introduction: In accordance with an outline addressed to Mr. Jack Crabb, Exploration Manager of Crows Nest Industries, Ltd. dated December 29, 1969 and a subsequent telephone conversation between Mr. Crabb and K. E. Lindsay of Commercial Testing & Engineering Co., the procedures of a washability investigation on raw coal from Fernie #8 and #9 Seams was agreed upon.

Purpose: The purpose of this investigation was to determine the washability characteristics of these coals with respect to dry ash, dry sulfur, dry volatile, and the Free Swelling Index.

Method of Procedure: Upon receipt of the samples at the South Holland laboratory of C. T. & E. Co., the samples were screened over round hole screens and Tyler Sieves to produce the following sizes:

2"	X	1-1/2"
1-1/2"	X	3/4"
3/4"	X	1/2"
1/2"	X	1/4"
1/4"	X	28 Mesh
28 Mesh	X	200 Mesh
200 Mesh	X	0

Any plus 2" particles were crushed to 2" X 0 and combined with the 2" X 0 natural.



All size fractions except the 28 X 200 Mesh and 200 Mesh X 0 sizes were subjected to float and sink fractionation in organic solutions at the following specific gravities:

1.30
1.35
1.40
1.50
1.60
1.80

The 28 Mesh X 200 Mesh and 200 Mesh X 0 material were recombined, thoroughly mixed, and subjected to froth flotation separation in a Denver Test Cell.

All size gravity fractions and the froth and tailings from the 28 Mesh X 0 material were analyzed for % Dry Ash, % Dry Sulfur, % Dry Volatile, and Free Swelling Index.

In addition a Tumbler Test (ASTM-D-441-45) was run on a representative portion of each seam.

Report of Results: Calculations were made to determine the cumulative recovery and cumulative reject at each size gravity and for a Composite 2" X 28 Mesh product. Washability curves have been drawn. The tabulated analytical results are included hereinafter.

Respectfully submitted,

I. O. Foster
I. O. Foster, Manager
COMMERCIAL TESTING & ENGINEERING CO.



Crows Nest Industries, Ltd.
Fernie, British Columbia
FERNIE #8

SCREEN ANALYSIS

Total Seam Crushed to 2" X 0

<u>Passing</u>	<u>Retained</u>	<u>% Wt.</u>	<u>Cumulative % Wt.</u>
2" Rd.X	1-1/2" Rd.	11.4	11.4
1-1/2" X	3/4" Rd.	13.1	24.5
3/4" Rd.X	1/2" Rd.	10.2	34.7
1/2" Rd.X	1/4" Rd.	8.1	42.8
1/4" Rd.X	28 Mesh	39.9	82.7
28 Mesh X	200 Mesh	16.0	98.7
200 Mesh		1.3	100.0



Crows Nest Industries Ltd.
 Fernie, British Columbia
 FERNIE #8

Composite 2 X 28 M

February 12, 1970

Composite 2" X 28 Mesh = 82.7% of Total Seam Crushed to 2" X 0

COMMERCIAL TESTING & ENGINEERING CO.

SPECIFIC GRAVITY		DRY BASIS				CUMULATIVE RECOVERY (Float)				CUMULATIVE REJECT (Sink)			
Sink	Float	% Wt.	% Ash	% Sul.	% Vol.	% Wt.	% Ash	% Sul.	% Vol.	% Wt.	% Ash	% Sul.	% Vol.
	1.30	14.9	3.39	0.53	24.26	14.9	3.39	0.53	24.26	100.0	19.26	0.45	19.70
1.30	1.35	21.7	6.60	0.48	20.77	36.6	5.29	0.50	22.19	85.1	22.04	0.43	18.90
1.35	1.40	19.8	10.00	0.45	19.62	56.4	6.95	0.48	21.29	63.4	27.32	0.41	18.26
1.40	1.50	19.7	16.30	0.42	19.00	76.1	9.37	0.47	20.70	43.6	35.19	0.40	17.64
1.50	1.60	7.4	25.19	0.39	18.39	83.5	10.77	0.46	20.49	23.9	50.76	0.38	16.52
1.60	1.80	5.0	36.92	0.46	17.55	88.5	12.25	0.46	20.33	16.5	62.23	0.38	15.68
1.80		11.5	73.23	0.34	14.86	100.0	19.26	0.45	19.70	11.5	73.23	0.34	14.86

Weighted Average.

2'x28M $82.7 \times 73.5 = 60.6$
 2"X 0 $17.3 \times 89.1 = 15.4$
 76.0

$82.7 \times 73.5 \times 8.8 = 5.35$
 $89.1 \times 17.3 \times 11.12 = 1.71$
 7.06

avg ash

Weighted avg ash 9.28

Job Crows Nest Ind., Ltd.
 Lab. No. Calculated Composite
 Mine Fernie #8 Seam
 Size 2" X 28 Mesh
 Raw Coal Ash 19.26%
 Raw Coal Sul. 0.45%

Commercial Testing & Engineering Co.
 CONSULTING FUEL ENGINEERS
 AND CHEMISTS
 CHICAGO, ILL.

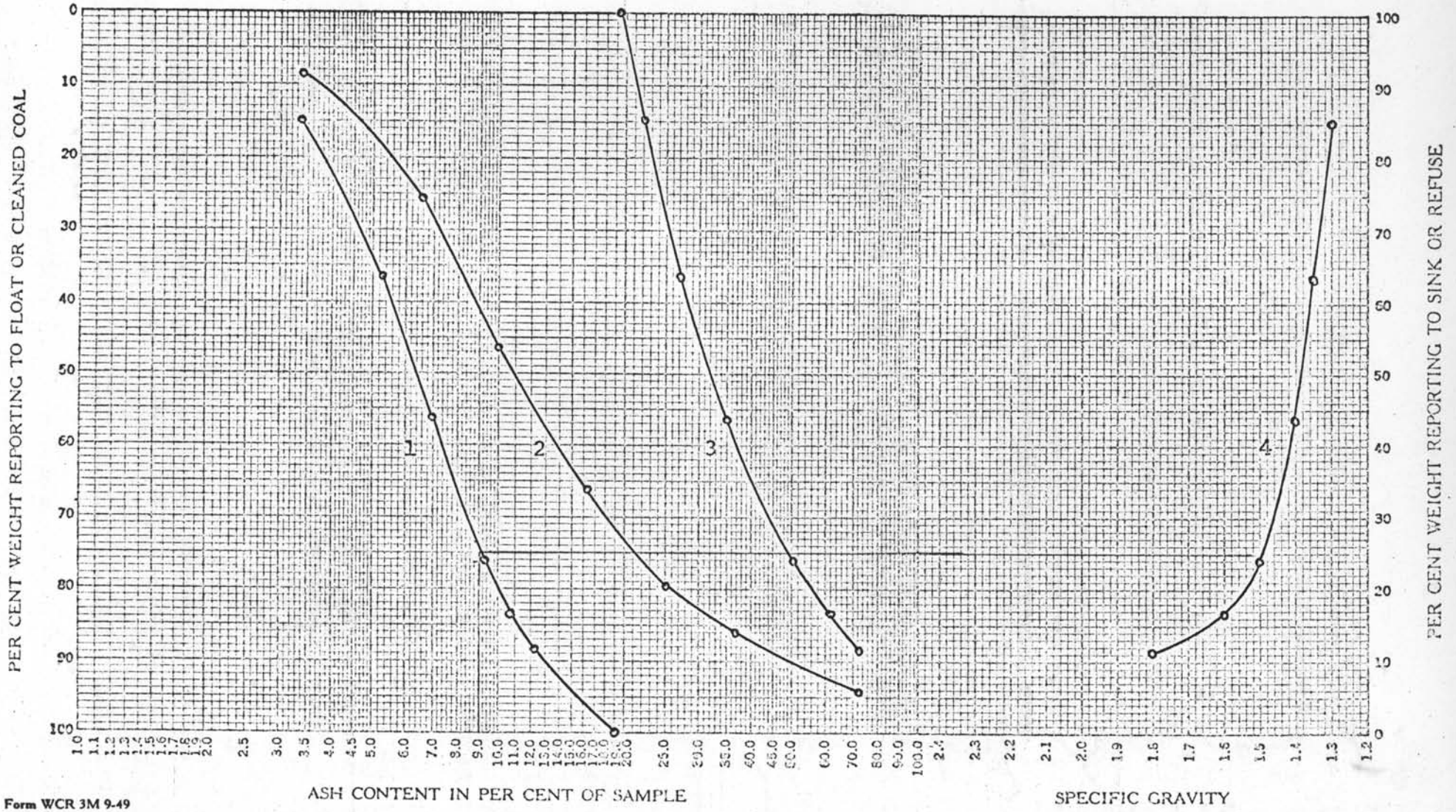
Charleston, W. Va.

Terre Haute, Ind.

CURVE LEGEND

- 1 Cumulative Coal-Ash
- 2 Coal Characteristic
- 3 Cumulative Refuse-Ash
- 4 Yield-Specific Gravity
- 5 Separation Effected

WASHABILITY CURVES



Crows Nest Industries Ltd.
 Fernie, British Columbia
 FERNIE #8

CH 379234 - CH 379240

February 12, 1970

2" X 1-1/2" = 11.4% of Total Seam

COMMERCIAL TESTING & ENGINEERING CO.

SPECIFIC GRAVITY		DRY BASIS				CUMULATIVE RECOVERY (Float)				CUMULATIVE REJECT (Sink)			
Sink	Float	% Wt.	% Ash	% Sul.	% Vol.	% Wt.	% Ash	% Sul.	% Vol.	% Wt.	% Ash	% Sul.	% Vol.
	1.30	15.5	5.87	0.65	21.86	15.5	5.87	0.65	21.86	100.0	19.28	0.43	19.41
1.30	1.35	32.3	8.70	0.46	19.69	47.8	7.78	0.52	20.39	84.5	21.75	0.39	18.96
1.35	1.40	14.9	13.54	0.51	19.88	62.7	9.15	0.52	20.27	52.2	29.82	0.35	18.50
1.40	1.50	17.5	20.20	0.26	18.73	80.2	11.56	0.46	19.94	37.3	36.32	0.29	17.95
1.50	1.60	6.6	25.89	0.40	18.64	86.8	12.65	0.46	19.84	19.8	50.57	0.32	17.27
1.60	1.80	3.4	35.92	0.42	18.10	90.2	13.53	0.46	19.77	13.2	62.91	0.28	16.58
1.80		9.8	72.27	0.23	16.05	100.0	19.28	0.43	19.41	9.8	72.27	0.23	16.05

FREE SWELLING INDEX

<u>1.30Fl.</u>	<u>1.30-1.35</u>	<u>1.35-1.40</u>	<u>1.40-1.45</u>	<u>1.45-1.50</u>	<u>1.50-1.60</u>	<u>1.60-1.80</u>	<u>1.80 Sink</u>
2-1/2	1	1	1	1	1	1	0

Job Crows Nest Ind., Ltd.
 Lab. No. CH379234-CH379240
 Mine Fernie #8 Seam
 Size 2" X 1-1/2"
 Raw Coal Ash 19.28%
 Raw Coal Sul. 0.43%

Commercial Testing & Engineering Co.

CONSULTING FUEL ENGINEERS
 AND CHEMISTS
 CHICAGO, ILL.

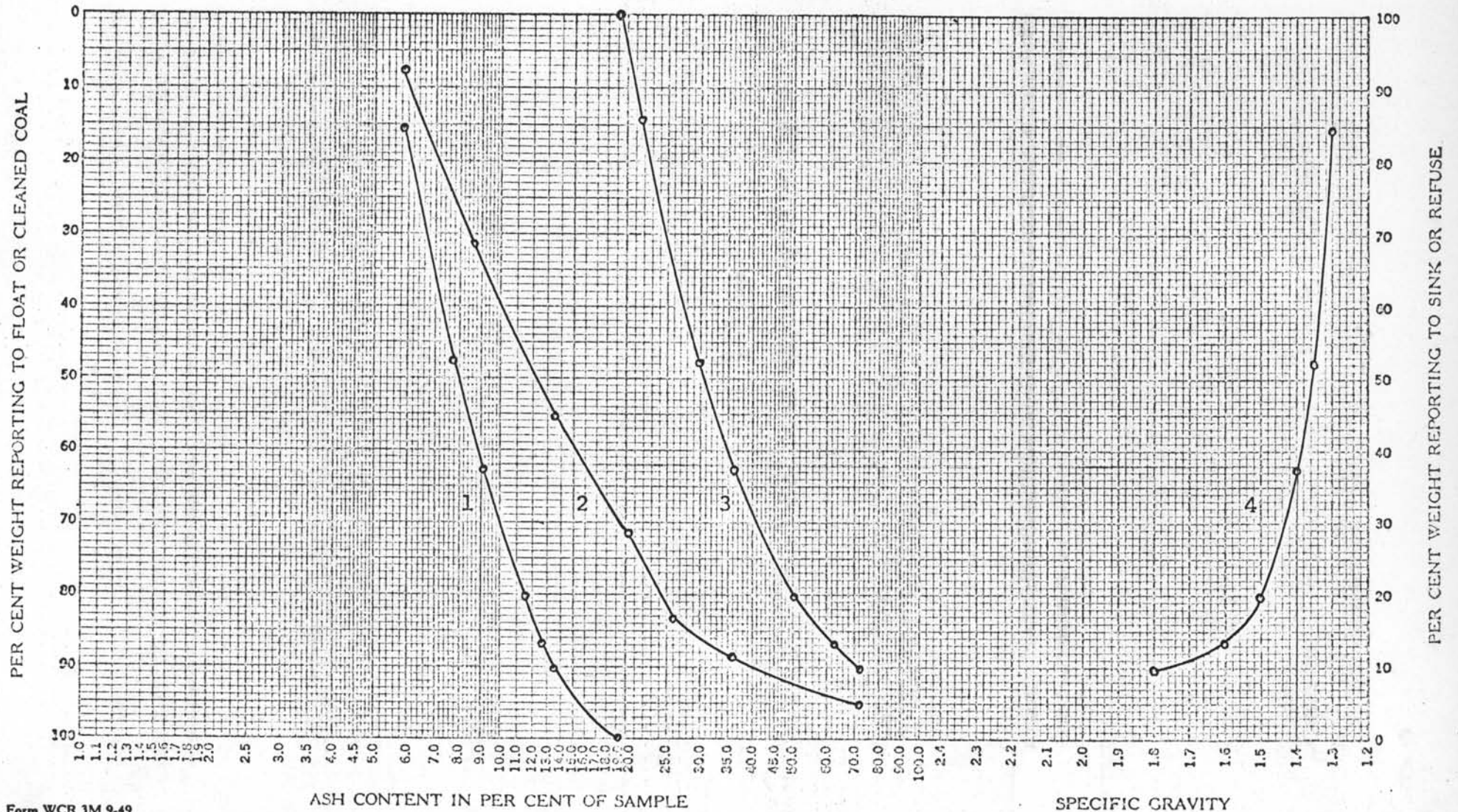
Charleston, W. Va.

Terre Haute, Ind.

CURVE LEGEND

- 1 Cumulative Coal-Ash
- 2 Coal Characteristic
- 3 Cumulative Refuse-Ash
- 4 Yield-Specific Gravity
- 5 Separation Effected

WASHABILITY CURVES



Crows Nest Industries Ltd.
 Fernie, British Columbia
 FERNIE #8

CH 379241 - CH 379247

February 12, 1970

1-1/2" X 3/4" = 13.1% of Total Seam Crushed to 2" X 0

COMMERCIAL TESTING & ENGINEERING CO.



SPECIFIC GRAVITY		DRY BASIS				CUMULATIVE RECOVERY (Float)				CUMULATIVE REJECT (Sink)			
Sink	Float	% Wt.	% Ash	% Sul.	% Vol.	% Wt.	% Ash	% Sul.	% Vol.	% Wt.	% Ash	% Sul.	% Vol.
	1.30	2.2	4.02	0.61	23.89	2.2	4.02	0.61	23.89	100.0	18.48	0.40	19.60
1.30	1.35	24.9	6.35	0.51	21.11	27.1	6.16	0.52	21.34	97.8	18.80	0.40	19.50
1.35	1.40	27.2	9.23	0.39	19.63	54.3	7.70	0.45	20.48	72.9	23.06	0.36	18.95
1.40	1.50	23.6	15.43	0.39	19.72	77.9	10.04	0.43	20.25	45.7	31.29	0.34	18.54
1.50	1.60	8.9	25.94	0.33	18.48	86.8	11.67	0.42	20.07	22.1	48.22	0.30	17.29
1.60	1.80	3.8	40.73	0.33	17.20	90.6	12.89	0.42	19.95	13.2	63.25	0.27	16.48
1.80		9.4	72.35	0.25	16.19	100.0	18.48	0.40	19.60	9.4	72.35	0.25	16.19

FREE SWELLING INDEX

1.30 Fl.	1.30-1.35	1.35-1.40	1.40-1.45	1.45-1.50	1.50-1.60	1.60-1.80	1.80 Sink
7	1	1	1	1	1	1	0

Job Crows Nest Ind., Ltd.
 Lab. No. CH379241-CH379247
 Mine Fernie #8 Seam
 Size 1-1/2" X 3/4"
 Raw Coal Ash 18.48%
 Raw Coal Sul. 0.40%

Commercial Testing & Engineering Co.

CONSULTING FUEL ENGINEERS
 AND CHEMISTS
 CHICAGO, ILL.

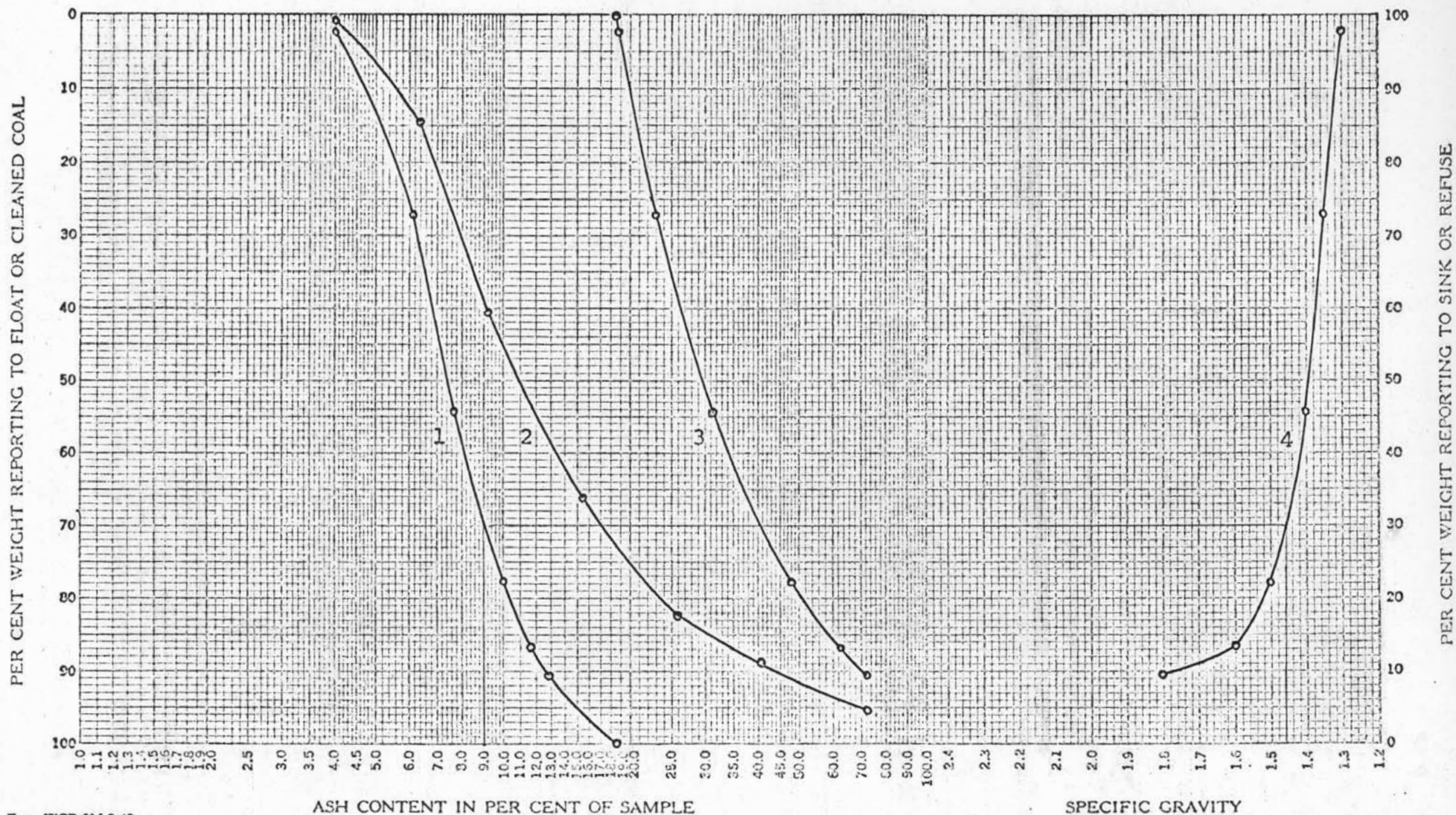
Charleston, W. Va.

Terre Haute, Ind.

CURVE LEGEND

- 1 Cumulative Coal-Ash
- 2 Coal Characteristic
- 3 Cumulative Refuse-Ash
- 4 Yield-Specific Gravity
- 5 Separation Effected

WASHABILITY CURVES



Crows Nest Industries Ltd.
 Fernie, British Columbia
 FERNIE #8

CH 379248 - CH 379254

February 12, 1970

3/4" X 1/2" = 10.2% of Total Seam Crushed to 2" X 0

COMMERCIAL TESTING & ENGINEERING CO.

SPECIFIC GRAVITY		% Wt.	DRY BASIS			CUMULATIVE RECOVERY (Float)				CUMULATIVE REJECT (Sink)			
Sink	Float		% Ash	% Sul.	% Vol.	% Wt.	% Ash	% Sul.	% Vol.	% Wt.	% Ash	% Sul.	% Vol.
	1.30	1.8	3.89	0.54	23.66	1.8	3.89	0.54	23.66	100.0	20.86	0.42	18.76
1.30	1.35	24.7	6.51	0.41	20.82	26.5	6.33	0.42	21.01	98.2	21.17	0.42	18.68
1.35	1.40	26.2	10.56	0.42	19.10	52.7	8.43	0.42	20.06	73.5	26.10	0.43	17.95
1.40	1.50	20.3	15.60	0.48	18.53	73.0	10.43	0.44	19.64	47.3	34.71	0.43	17.32
1.50	1.60	8.8	24.42	0.34	18.29	81.8	11.93	0.43	19.49	27.0	49.09	0.39	16.41
1.60	1.80	5.5	36.07	0.47	17.44	87.3	13.45	0.43	19.36	18.2	61.00	0.41	15.50
1.80		12.7	71.79	0.39	14.66	100.0	20.86	0.42	18.76	12.7	71.79	0.39	14.66

FREE SWELLING INDEX

<u>1.30 Fl.</u>	<u>1.30-1.35</u>	<u>1.35-1.40</u>	<u>1.40-1.45</u>	<u>1.45-1.50</u>	<u>1.50-1.60</u>	<u>1.60-1.80</u>	<u>1.80 Sink</u>
8	1	1	1	1	1	1	0

Job Crows Nest Ind., Ltd.
 Lab. No. CH379248-CH379254
 Mine Fernie #8 Seam
 Size 3/4" X 1/2"
 Raw Coal Ash 20.86%
 Raw Coal Sul. 0.42%

Commercial Testing & Engineering Co.

CONSULTING FUEL ENGINEERS
 AND CHEMISTS
 CHICAGO, ILL.

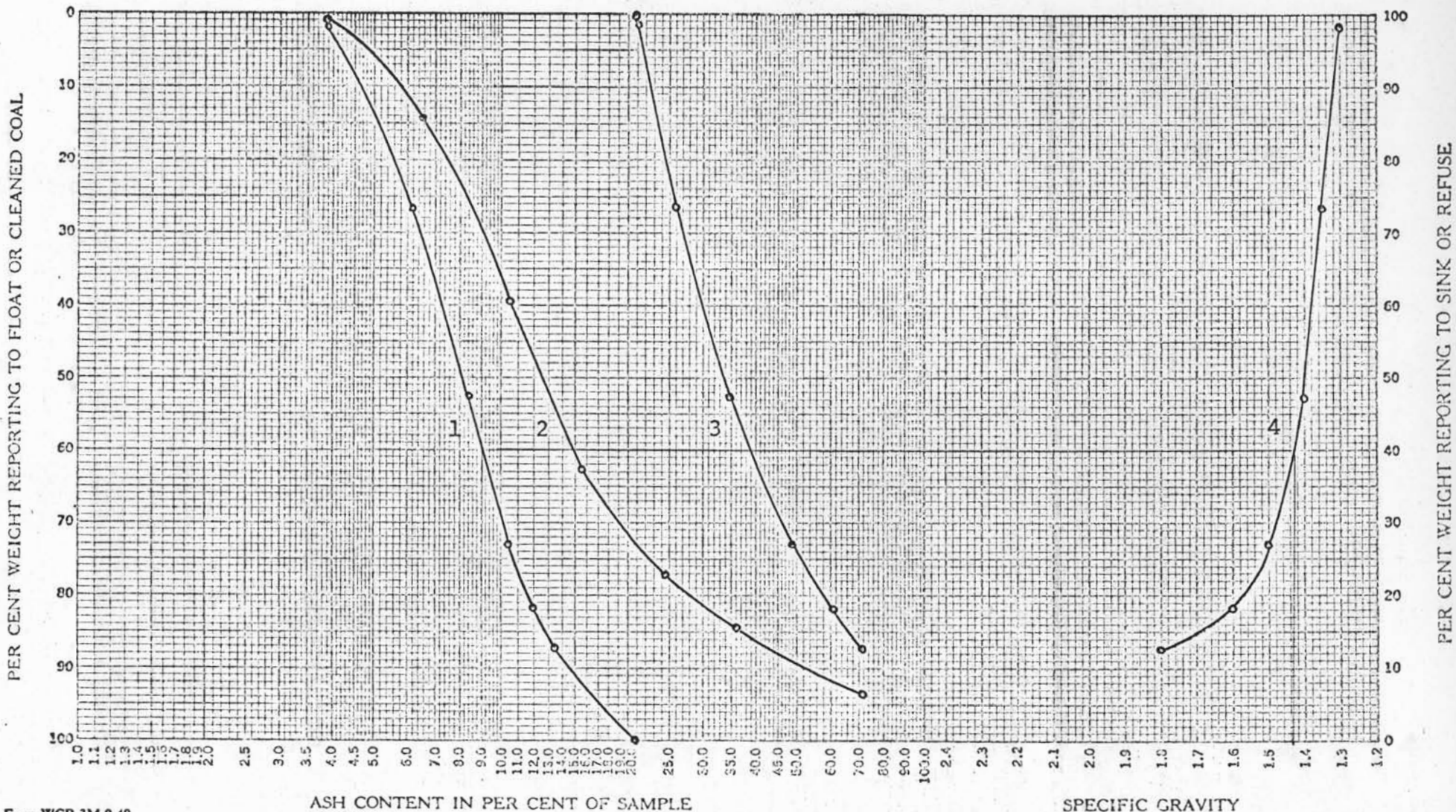
Charleston, W. Va.

Terre Haute, Ind.

CURVE LEGEND

- 1 Cumulative Coal-Ash
- 2 Coal Characteristic
- 3 Cumulative Refuse-Ash
- 4 Yield-Specific Gravity
- 5 Separation Effected

WASHABILITY CURVES



Crows Nest Industries Ltd.
 Fernie, British Columbia
 FERNIE #8

CH 379255 - CH 379261

February 12, 1970

1/2" X 1/4" = 8.1% of Total Seam Crushed to 2" X 0

COMMERCIAL TESTING & ENGINEERING CO.



SPECIFIC GRAVITY		% Wt.	DRY BASIS			CUMULATIVE RECOVERY (Float)				CUMULATIVE REJECT (Sink)			
Sink	Float		% Ash	% Sul.	% Vol.	% Wt.	% Ash	% Sul.	% Vol.	% Wt.	% Ash	% Sul.	% Vol.
	1.30	7.6	3.76	0.60	22.92	7.6	3.76	0.60	22.92	100.0	22.88	0.48	18.75
1.30	1.35	18.2	6.19	0.57	20.21	25.8	5.47	0.58	21.01	92.4	24.45	0.47	18.41
1.35	1.40	23.9	11.12	0.47	19.72	49.7	8.19	0.53	20.39	74.2	28.93	0.44	17.97
1.40	1.50	22.4	18.57	0.56	18.78	72.1	11.41	0.54	19.89	50.3	37.40	0.43	17.13
1.50	1.60	8.1	25.53	0.38	18.60	80.2	12.84	0.52	19.76	27.9	52.51	0.33	15.81
1.60	1.80	5.9	37.78	0.43	17.68	86.1	14.55	0.51	19.62	19.8	63.56	0.31	14.67
1.80		13.9	74.49	0.26	13.39	100.0	22.88	0.48	18.75	13.9	74.49	0.26	13.39

FREE SWELLING INDEX

1.30 Fl.	1.30-1.35	1.35-1.40	1.40-1.45	1.45-1.50	1.50-1.60	1.60-1.80	1.80 Sink
7-1/2	3	1	1	1	1	1	0

Job Crows Nest Ind., Ltd.
 Lab. No. CH379255-CH379261
 Mine Fernie #8 Seam
 Size 1/2" X 1/4"
 Raw Coal Ash 22.88%
 Raw Coal Sul. 0.48%

Commercial Testing & Engineering Co.

CONSULTING FUEL ENGINEERS
 AND CHEMISTS

CHICAGO, ILL.

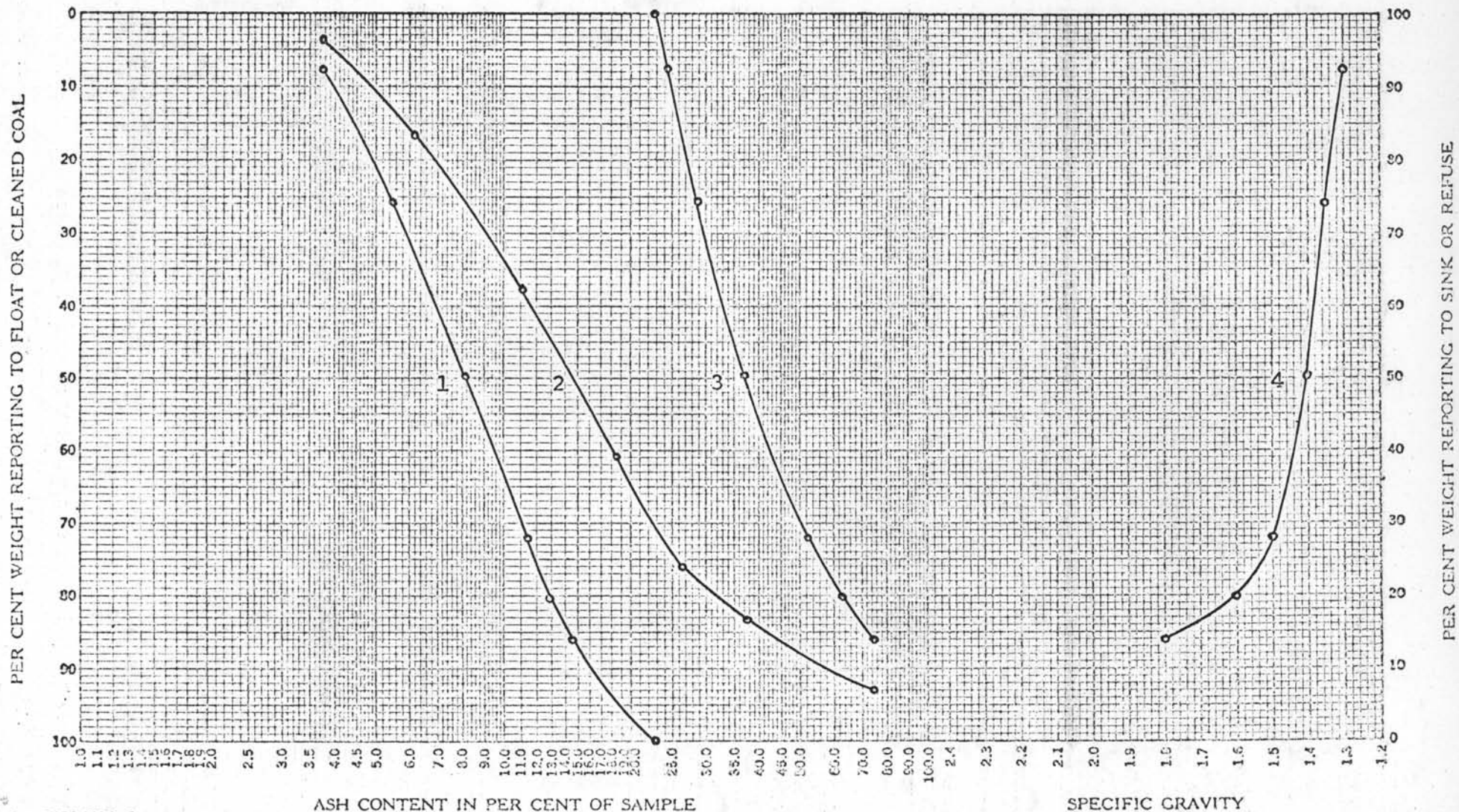
Charleston, W. Va.

Terre Haute, Ind.

CURVE LEGEND

- 1 Cumulative Coal-Ash
- 2 Coal Characteristic
- 3 Cumulative Refuse-Ash
- 4 Yield-Specific Gravity
- 5 Separation Effected

WASHABILITY CURVES



Crow's Nest Industries Ltd.
Ferne, British Columbia
FERNIE #8

CH 379262 - CH 379268

February 12, 1970

1/4" X 28 Mesh = 39.9% of Total Seam Crushed to 2" X 0

COMMERCIAL TESTING & ENGINEERING CO.

SPECIFIC GRAVITY		DRY BASIS				CUMULATIVE RECOVERY (Float)				CUMULATIVE REJECT (Sink)			
Sink	Float	% Wt.	% Ash	% Sul.	% Vol.	% Wt.	% Ash	% Sul.	% Vol.	% Wt.	% Ash	% Sul.	% Vol.
	1.30	23.8	2.88	0.50	24.82	23.8	2.88	0.50	24.82	100.0	18.42	0.46	20.24
1.30	1.35	17.5	5.74	0.47	21.28	41.3	4.09	0.49	23.32	76.2	23.28	0.45	18.81
1.35	1.40	16.3	8.93	0.48	19.74	57.6	5.46	0.49	22.31	58.7	28.50	0.44	18.08
1.40	1.50	18.3	15.24	0.42	18.95	75.9	7.82	0.47	21.50	42.4	36.03	0.43	17.44
1.50	1.60	6.6	24.84	0.44	18.26	82.5	9.18	0.47	21.24	24.1	51.81	0.43	16.29
1.60	1.80	5.5	36.26	0.50	17.53	88.0	10.87	0.47	21.01	17.5	61.99	0.42	15.55
1.80		12.0	73.78	0.39	14.64	100.0	18.42	0.46	20.24	12.0	73.78	0.39	14.64

FREE SWELLING INDEX

<u>1.30 Fl.</u>	<u>1.30-1.35</u>	<u>1.35-1.40</u>	<u>1.40-1.45</u>	<u>1.45-1.50</u>	<u>1.50-1.60</u>	<u>1.60-1.80</u>	<u>1.80 Sink</u>
8-1/2	5	1	1	1	1	1	0

Job Crows Nest Ind., Ltd.
 Lab. No. CH379262-CH379268
 Mine Fernie #8 Seam
 Size 1/4" X 28 Mesh
 Raw Coal Ash 18.42%
 Raw Coal Sul. 0.46%

Commercial Testing & Engineering Co.
 CONSULTING FUEL ENGINEERS
 AND CHEMISTS
 CHICAGO, ILL.

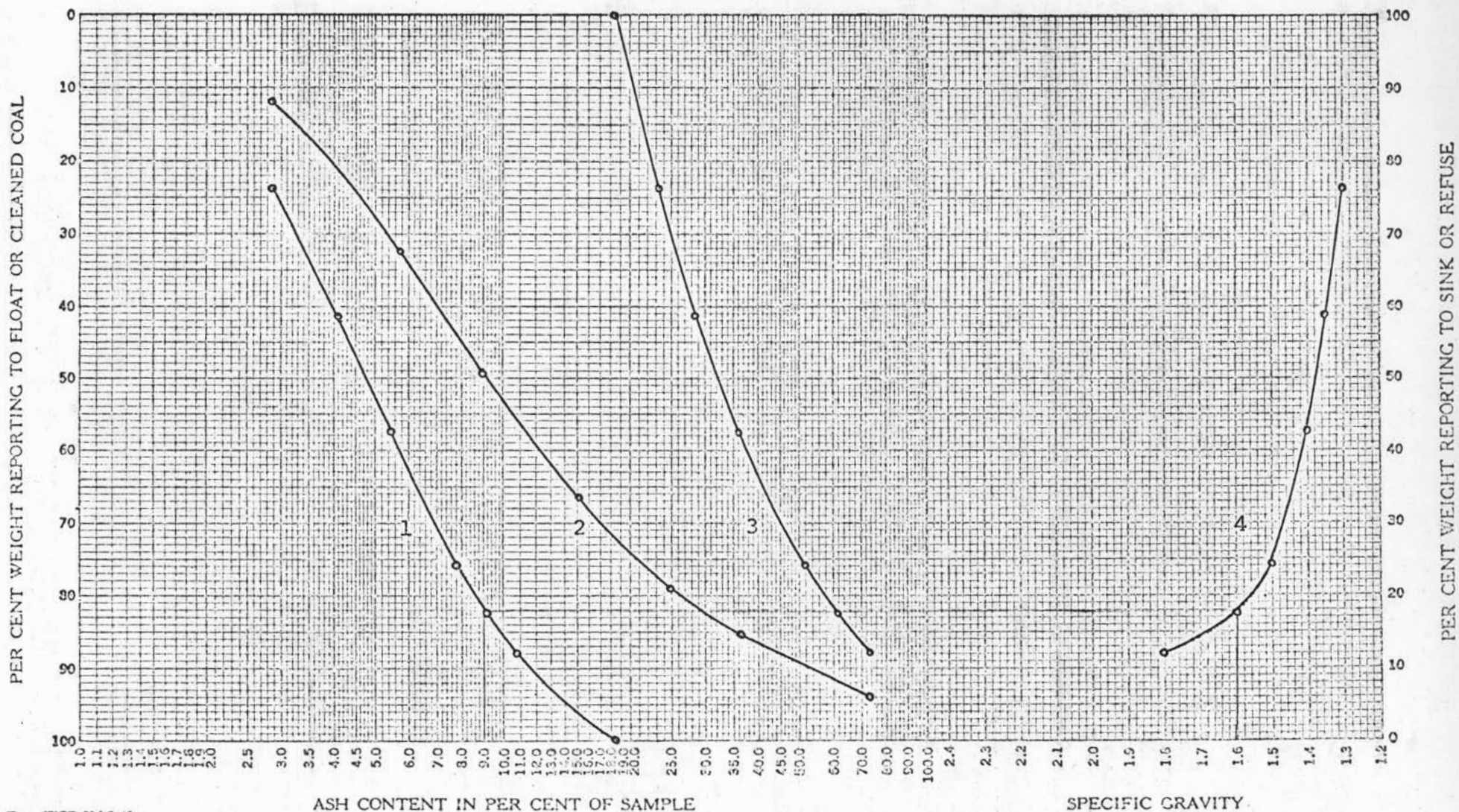
Charleston, W. Va.

Terre Haute, Ind.

CURVE LEGEND

- 1 Cumulative Coal-Ash
- 2 Coal Characteristic
- 3 Cumulative Refuse-Ash
- 4 Yield-Specific Gravity
- 5 Separation Effected

WASHABILITY CURVES



Crows Nest Industries Ltd.
 Fernie, British Columbia
 FERNIE #8

CH 379270 A & B

February 12, 1970

28 Mesh X 0 = 17.3% of Total Seam Crushed to 2" X 0

FROTH FLOTATION

- Conditioning time 5 Min., MIBC 1 Drop,
 Kerosene 1 Drop.

FROTH	<u>DRY BASIS</u>				<u>CUMULATIVE RECOVERY</u>				<u>FREE SWELLING INDEX</u>
	<u>% Wt.</u>	<u>% Ash</u>	<u>% Sul.</u>	<u>% Vol.</u>	<u>% Wt.</u>	<u>% Ash</u>	<u>% Sul.</u>	<u>% Vol.</u>	
	89.1	11.12	0.51	21.80	89.1	11.12	0.51	21.80	4
Tail-ings	10.9	48.69	1.14	17.03	100.0	15.22	0.58	21.28	1/2



COMMERCIAL TESTING & ENGINEERING CO.

Crows Nest Industries, Ltd.
Ferne, British Columbia

Ferne No. 8 Seam
Tumbler Test

Retained on	Passing	Weight Per Cent (1)	Average of Sieve Openings Inches (2)	Sieve Factor (3)	Prod. of (1 X 3)
SAMPLE					
1.06 In.	1.50 In.	100.0	1.280	1	100.0=S
TUMBLER COAL					
1.06 In.	1.50 In.	36.0	1.280	1	36.0
0.750 In.	1.06 In.	30.6	0.905	0.7	21.42
0.530 In.	0.750 In.	6.1	0.640	0.5	3.05
0.375 In.	0.530 In.	0.3	0.452	0.35	0.10
0.0469 In.	0.375 In.	1.5	0.211	0.16	0.240
0.0117 In.	0.0469 In.	3.6	0.029	0.023	0.083
	0.0117 In.	21.9	0.006	0.005	0.110
Total (Sum of Products (1) X (3) for tumbled coal - - - - -					61.00
Friability, per cent = $\frac{100(100-61.00)}{100} = 39.0$					



Crows Nest Industries, Ltd.
Fernie, British Columbia
FERNIE #9

SCREEN ANALYSIS

Total Seam Crushed to 2" X 0

<u>Passing</u>		<u>Retained</u>	<u>% Wt.</u>	<u>Cumulative Wt.</u>
2" Rd.	X	1-1/2" Rd.	10.9	10.9
1-1/2" Rd.	X	3/4" Rd.	16.0	26.9
3/4" Rd.	X	1/2" Rd.	14.2	41.1
1/2" Rd.	X	1/4" Rd.	17.3	58.4
1/4" Rd.	X	28 Mesh	30.8	89.2
28 Mesh	X	200 Mesh	9.9	99.1
20 Mesh			0.9	100.0



Crows Nest Industries, Ltd.
 Fernie, British Columbia
 FERNIE #9

Composite

February 12, 1970

Composite 2 X 28 = 89.2% of Total Seam Crushed to 2" X 0

COMMERCIAL TESTING & ENGINEERING CO.

SPECIFIC GRAVITY		DRY BASIS				CUMULATIVE RECOVERY (Float)				CUMULATIVE REJECT (Sink)			
Sink	Float	% Wt.	% Ash	% Sul.	% Vol.	% Wt.	% Ash	% Sul.	% Vol.	% Wt.	% Ash	% Sul.	% Vol.
	1.30	13.4	2.64	0.52	23.94	13.4	2.64	0.52	23.94	100.0	15.78	0.43	19.69
1.30	1.35	29.3	6.17	0.46	21.13	42.7	5.06	0.48	22.01	86.6	17.81	0.41	19.04
1.35	1.40	24.7	9.30	0.42	19.66	67.4	6.62	0.46	21.15	57.3	23.77	0.39	17.97
1.40	1.50	16.2	16.44	0.41	18.75	83.6	8.52	0.45	20.68	32.6	34.72	0.37	16.68
1.50	1.60	4.2	26.55	0.35	17.24	87.8	9.38	0.44	20.52	16.4	52.79	0.33	14.64
1.60	1.80	3.1	39.80	0.42	16.15	90.9	10.42	0.44	20.37	12.2	61.82	0.32	13.74
1.80		9.1	69.32	0.29	12.92	100.0	15.78	0.43	19.69	9.1	69.32	0.29	12.92

$$\begin{array}{r}
 78.3 \\
 9.33 \\
 \hline
 87.63
 \end{array}
 = \frac{87.8 \times 89.2 \times 9.38}{86.4 \times 10.8 \times 75.5}
 \begin{array}{r}
 7.84 \\
 .71 \\
 \hline
 8.04
 \end{array}$$

= 9.18% ash

Job Crows Nest Ind., Ltd.
 Lab. No. Calculated Composite
 Mine Fernie #9 Seam
 Size Composite 2" X 28
 Raw Coal Ash 15.78%
 Raw Coal Sul. 0.43%

Commercial Testing & Engineering Co.

CONSULTING FUEL ENGINEERS
 AND CHEMISTS
 CHICAGO, ILL.

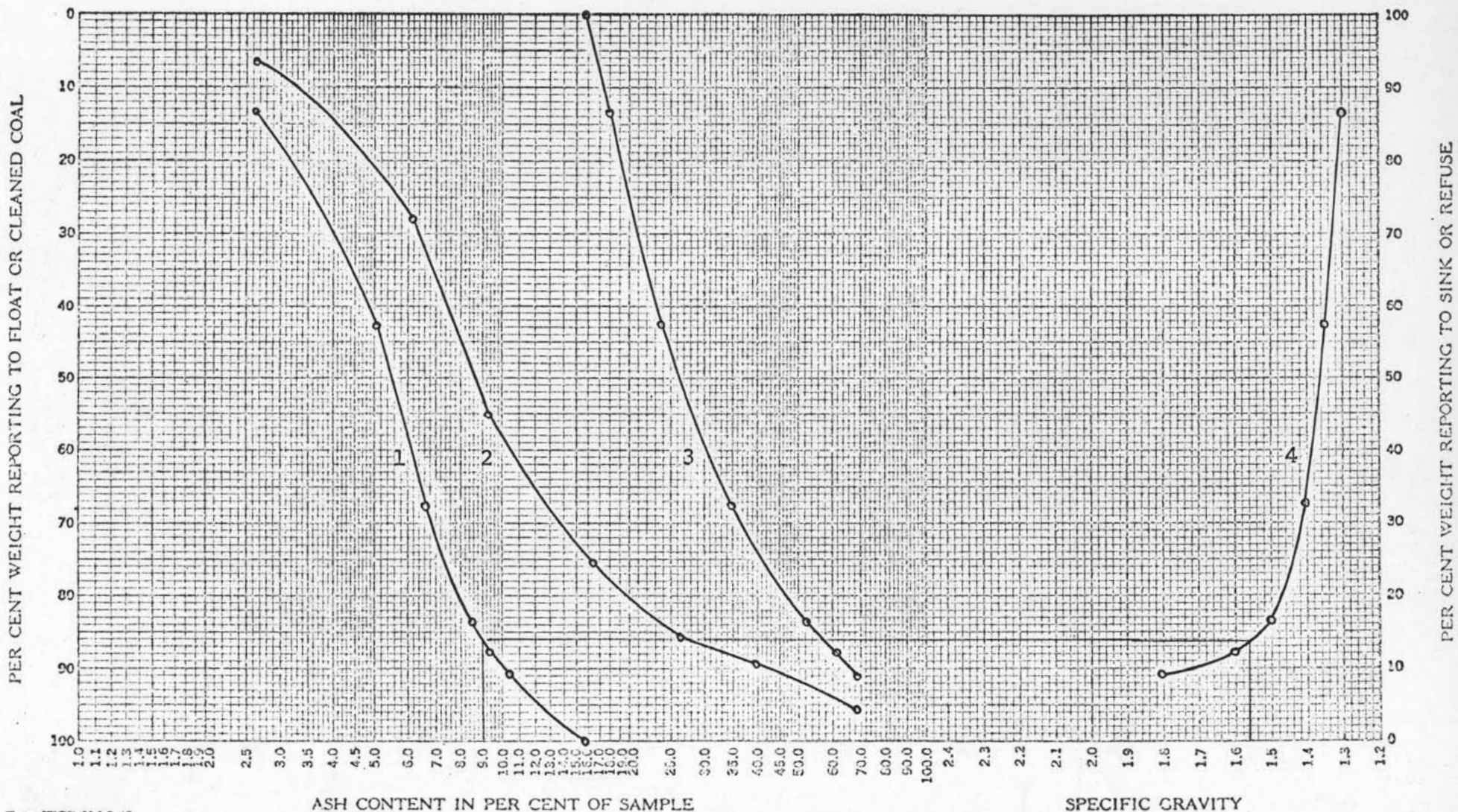
Charleston, W. Va.

Terre Haute, Ind.

CURVE LEGEND

- 1 Cumulative Coal-Ash
- 2 Coal Characteristic
- 3 Cumulative Refuse-Ash
- 4 Yield-Specific Gravity
- 5 Separation Effected

WASHABILITY CURVES



Crow's Nest Industries, Ltd.
 Fernie, British Columbia
 FERNIE #9

CH 379401 - CH 379407

February 12, 1970

2" X 1-1/2" = 10.9% of Total Seam Crushed to 2" X 0

COMMERCIAL TESTING & ENGINEERING CO.

SPECIFIC GRAVITY		DRY BASIS				CUMULATIVE RECOVERY (Float)				CUMULATIVE REJECT (Sink)			
Sink	Float	% Wt.	% Ash	% Sul.	% Vol.	% Wt.	% Ash	% Sul.	% Vol.	% Wt.	% Ash	% Sul.	% Vol.
	1.30	5.1	4.49	0.43	22.47	5.1	4.49	0.43	22.47	100.0	15.52	0.41	19.63
1.30	1.35	34.8	6.15	0.55	21.55	39.9	5.94	0.53	21.67	94.9	16.11	0.41	19.48
1.35	1.40	28.3	9.00	0.38	19.88	68.2	7.21	0.47	20.93	60.1	21.88	0.32	18.28
1.40	1.50	15.2	16.03	0.33	18.86	83.4	8.82	0.44	20.55	31.8	33.34	0.28	16.86
1.50	1.60	4.9	26.78	0.28	17.09	88.3	9.81	0.44	20.36	16.6	49.20	0.23	15.04
1.60	1.80	3.6	38.73	0.28	15.48	91.9	10.95	0.43	20.17	11.7	58.59	0.20	14.18
1.80		8.1	67.41	0.17	13.60	100.0	15.52	0.41	19.63	8.1	67.41	0.17	13.60

FREE SWELLING INDEX

<u>1.30 Fl.</u>	<u>1.30-1.35</u>	<u>1.35-1.40</u>	<u>1.40-1.45</u>	<u>1.45-1.50</u>	<u>1.50-1.60</u>	<u>1.60-1.80</u>	<u>1.80 Sink</u>
8	4	1	1	1	1	1	1/2

Job Crows Nest Ind., Ltd.
 Lab. No. CH379401-CH379407
 Mine Fernie #9 Seam
 Size 2" X 1-1/2"
 Raw Coal Ash 15.52%
 Raw Coal Sul. 0.41%

Commercial Testing & Engineering Co.
 CONSULTING FUEL ENGINEERS
 AND CHEMISTS
 CHICAGO, ILL.

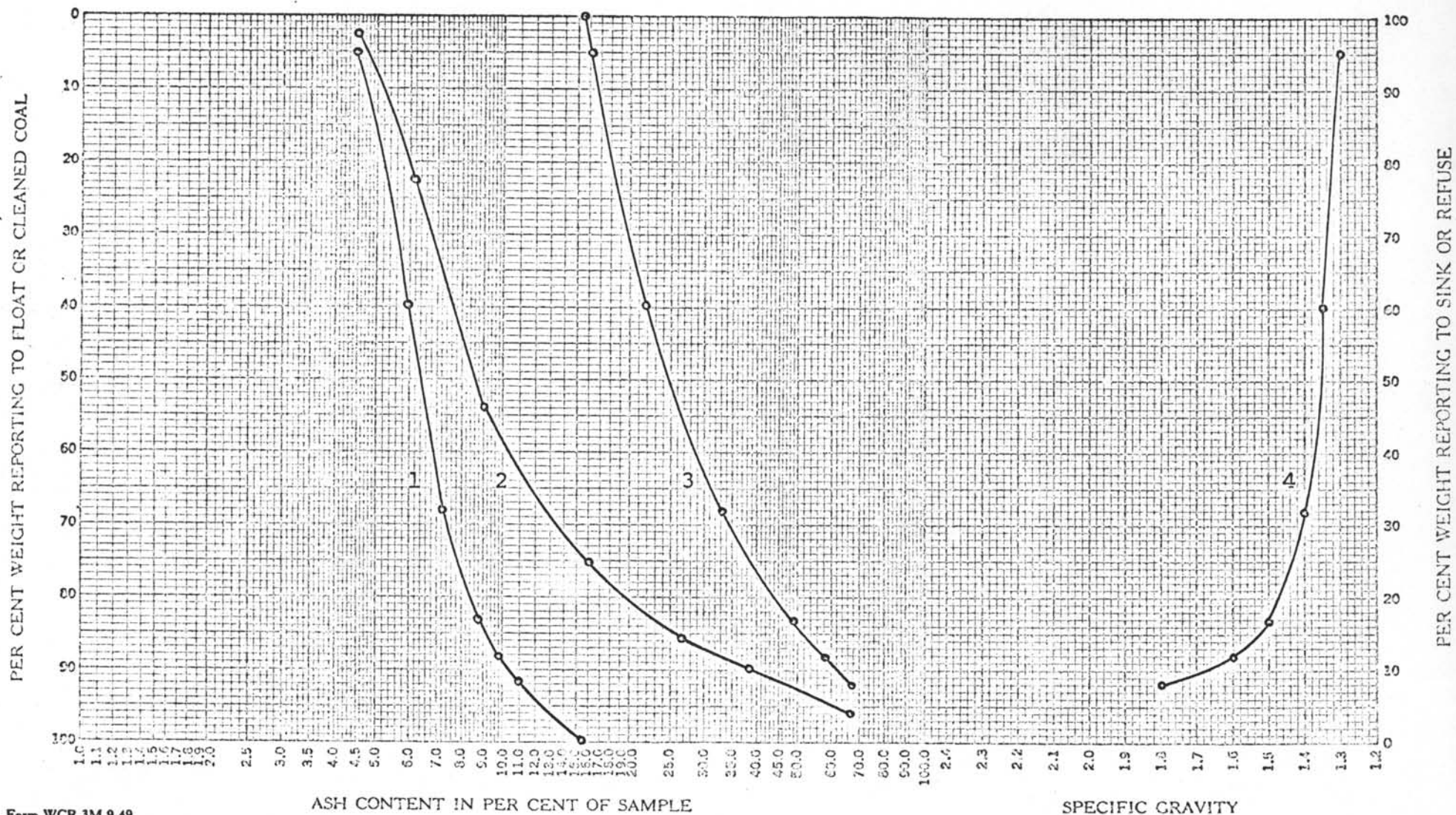
Charleston, W. Va.

Terre Haute, Ind.

CURVE LEGEND

- 1 Cumulative Coal-Ash
- 2 Coal Characteristic
- 3 Cumulative Refuse-Ash
- 4 Yield-Specific Gravity
- 5 Separation Effected

WASHABILITY CURVES



Crows Nest Industries, Ltd.
Fernie, British Columbia
FERNIE #9

CH 379408 - CH 379414

February 12, 1970

1-1/2" X 3/4" = 16.0% of Total Seam Crushed to 2" X 0

COMMERCIAL TESTING & ENGINEERING CO.



SPECIFIC GRAVITY		DRY BASIS				CUMULATIVE RECOVERY (Float)				CUMULATIVE REJECT (Sink)			
Sink	Float	% Wt.	% Ash	% Sul.	% Vol.	% Wt.	% Ash	% Sul.	% Vol.	% Wt.	% Ash	% Sul.	% Vol.
	1.30	4.2	5.98	0.37	22.70	4.2	5.98	0.37	22.70	100.0	17.43	0.31	19.33
1.30	1.35	37.2	8.06	0.38	20.90	41.4	7.85	0.38	21.08	95.8	17.93	0.31	19.19
1.35	1.40	27.5	9.57	0.33	19.82	68.9	8.54	0.36	20.58	58.6	24.02	0.27	18.10
1.40	1.50	13.8	17.23	0.25	18.94	82.7	9.99	0.34	20.31	31.1	37.13	0.21	16.58
1.50	1.60	4.4	27.30	0.25	17.03	87.1	10.86	0.34	20.14	17.3	53.01	0.19	14.69
1.60	1.80	3.0	38.98	0.24	16.09	90.1	11.80	0.33	20.00	12.9	61.77	0.16	13.90
1.80		9.9	68.68	0.14	13.23	100.0	17.43	0.31	19.33	9.9	68.68	0.14	13.23

FREE SWELLING INDEX

<u>1.30 Fl.</u>	<u>1.30-1.35</u>	<u>1.35-1.40</u>	<u>1.40-1.45</u>	<u>1.45-1.50</u>	<u>1.50-1.60</u>	<u>1.60-1.80</u>	<u>1.80 Sink</u>
8-1/2	5	1	1	1	1	1	1/2

Job Crows Nest Ind., Ltd.
 Lab. No. CH379408-CH379414
 Mine Fernie #9 Seam
 Size 1-1/2" X 3/4"
 Raw Coal Ash 17.43%
 Raw Coal Sul. 0.31%

Commercial Testing & Engineering Co.
 CONSULTING FUEL ENGINEERS
 AND CHEMISTS
 CHICAGO, ILL.

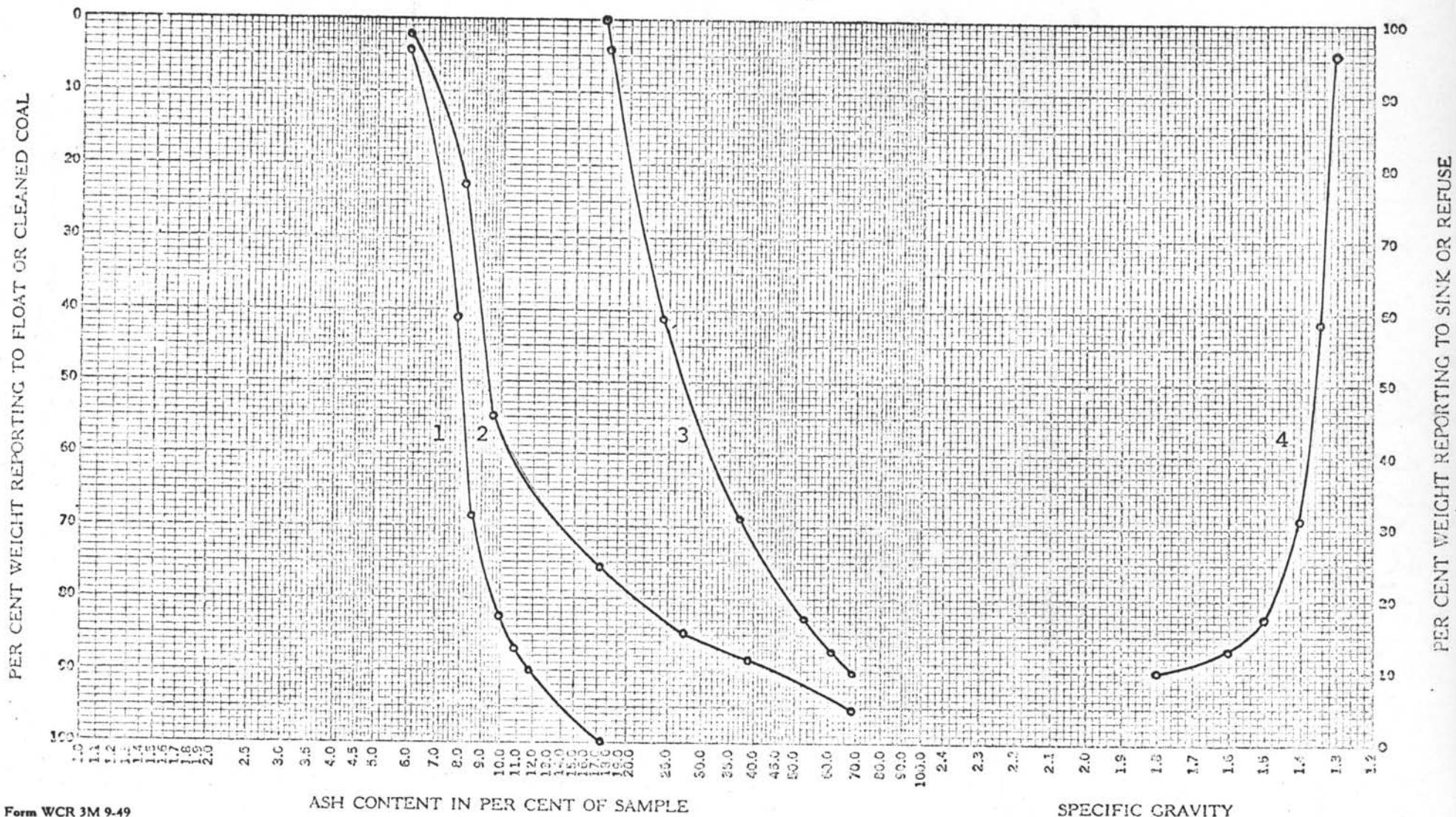
Charleston, W. Va.

Terre Haute, Ind.

CURVE LEGEND

- 1 Cumulative Coal-Ash
- 2 Coal Characteristic
- 3 Cumulative Refuse-Ash
- 4 Yield-Specific Gravity
- 5 Separation Effected

WASHABILITY CURVES



Crows Nest Industries, Ltd.
Fernie, British Columbia
FERNIE #9

CH 379415 - CH 379421

February 12, 1970

3/4" X 1/2" = 14.2% of Total Seam Crushed to 2" X 0

COMMERCIAL TESTING & ENGINEERING CO.



SPECIFIC GRAVITY		DRY BASIS				CUMULATIVE RECOVERY (Float)				CUMULATIVE REJECT (Sink)			
Sink	Float	% Wt.	% Ash	% Sul.	% Vol.	% Wt.	% Ash	% Sul.	% Vol.	% Wt.	% Ash	% Sul.	% Vol.
	1.30	7.3	5.32	0.43	22.24	7.3	5.32	0.43	22.24	100.0	17.77	0.37	19.09
1.30	1.35	29.5	6.66	0.40	20.71	36.8	6.39	0.41	21.01	92.7	18.75	0.37	18.80
1.35	1.40	28.6	10.04	0.39	19.32	65.4	7.99	0.40	20.27	63.2	24.39	0.35	17.91
1.40	1.50	16.0	17.00	0.40	18.86	81.4	9.76	0.40	20.00	34.6	36.26	0.32	16.74
1.50	1.60	4.5	23.84	0.29	17.48	85.9	10.50	0.39	19.86	18.6	52.82	0.26	14.91
1.60	1.80	3.5	35.52	0.28	16.52	89.4	11.48	0.39	19.73	14.1	62.07	0.25	14.09
1.80		10.6	70.84	0.24	13.29	100.0	17.77	0.37	19.05	10.6	70.84	0.24	13.29

FREE SWELLING INDEX

<u>1.30 Fl.</u>	<u>1.30-1.35</u>	<u>1.35-1.40</u>	<u>1.40-1.45</u>	<u>1.45-1.50</u>	<u>1.50-1.60</u>	<u>1.60-1.80</u>	<u>1.80 Sink</u>
8	5-1/2	1	1	1	1	1	0

Job Crows Nest Ind., Ltd.
 Lab. No. CH379415-CH379421
 Mine Fernie #9 Seam
 Size 3/4" X 1/2"
 Raw Coal Ash 17.77%
 Raw Coal Sul. 0.37%

Commercial Testing & Engineering Co.
 CONSULTING FUEL ENGINEERS
 AND CHEMISTS
 CHICAGO, ILL.

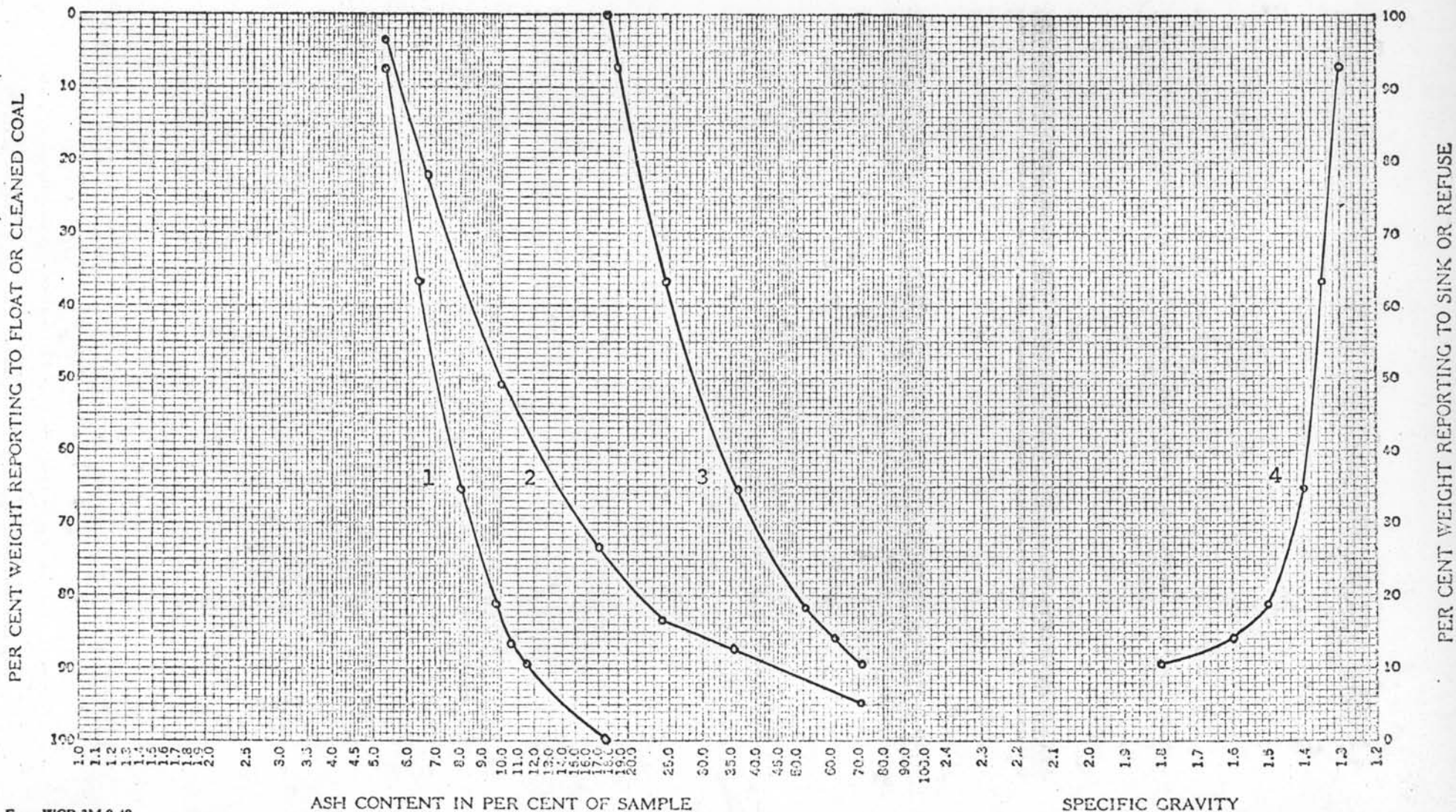
Charleston, W. Va.

Terre Haute, Ind.

CURVE LEGEND

- 1 Cumulative Coal-Ash
- 2 Coal Characteristic
- 3 Cumulative Refuse-Ash
- 4 Yield-Specific Gravity
- 5 Separation Effected

WASHABILITY CURVES



Crow's Nest Industries, Ltd.
Ferne, British Columbia
FERNIE #9

CH 379422 - CH 379428

February 12, 1970

1/2" X 1/4" = 17.3% of Total Seam Crushed to 2" X 0

COMMERCIAL TESTING & ENGINEERING CO.

SPECIFIC GRAVITY		DRY BASIS				CUMULATIVE RECOVERY (Float)				CUMULATIVE REJECT (Sink)			
Sink	Float	% Wt.	% Ash	% Sul.	% Vol.	% Wt.	% Ash	% Sul.	% Vol.	% Wt.	% Ash	% Sul.	% Vol.
	1.30	11.3	3.34	0.61	23.81	11.3	3.34	0.61	23.81	100.0	17.46	0.48	19.64
1.30	1.35	22.0	5.43	0.46	21.03	33.3	4.72	0.51	21.97	88.7	19.26	0.46	19.11
1.35	1.40	29.2	9.24	0.50	20.65	62.5	6.83	0.51	21.36	66.7	23.82	0.46	18.48
1.40	1.50	18.8	16.62	0.49	18.82	81.3	9.10	0.50	20.77	37.5	35.17	0.42	16.79
1.50	1.60	5.0	26.65	0.41	17.54	86.3	10.11	0.50	20.58	18.7	53.82	0.36	14.74
1.60	1.80	3.7	42.86	0.58	16.41	90.0	11.46	0.50	20.41	13.7	63.74	0.34	13.72
1.80		10.0	71.46	0.25	12.73	100.0	17.46	0.48	19.64	10.0	71.46	0.25	12.73

FREE SWELLING INDEX

<u>1.30 Fl.</u>	<u>1.30-1.35</u>	<u>1.35-1.40</u>	<u>1.40-1.45</u>	<u>1.45-1.50</u>	<u>1.50-1.60</u>	<u>1.60-1.80</u>	<u>1.80 Sink</u>
8-1/2	5-1/2	1	1	1	1	1	1/2

Job Crows Nest Ind., Ltd.
 Lab. No. CH 379422-CH379428
 Mine Fernie #9 Seam
 Size 1/2" X 1/4"
 Raw Coal Ash 17.46%
 Raw Coal Sul. 0.48%

Commercial Testing & Engineering Co.
 CONSULTING FUEL ENGINEERS
 AND CHEMISTS
 CHICAGO, ILL.

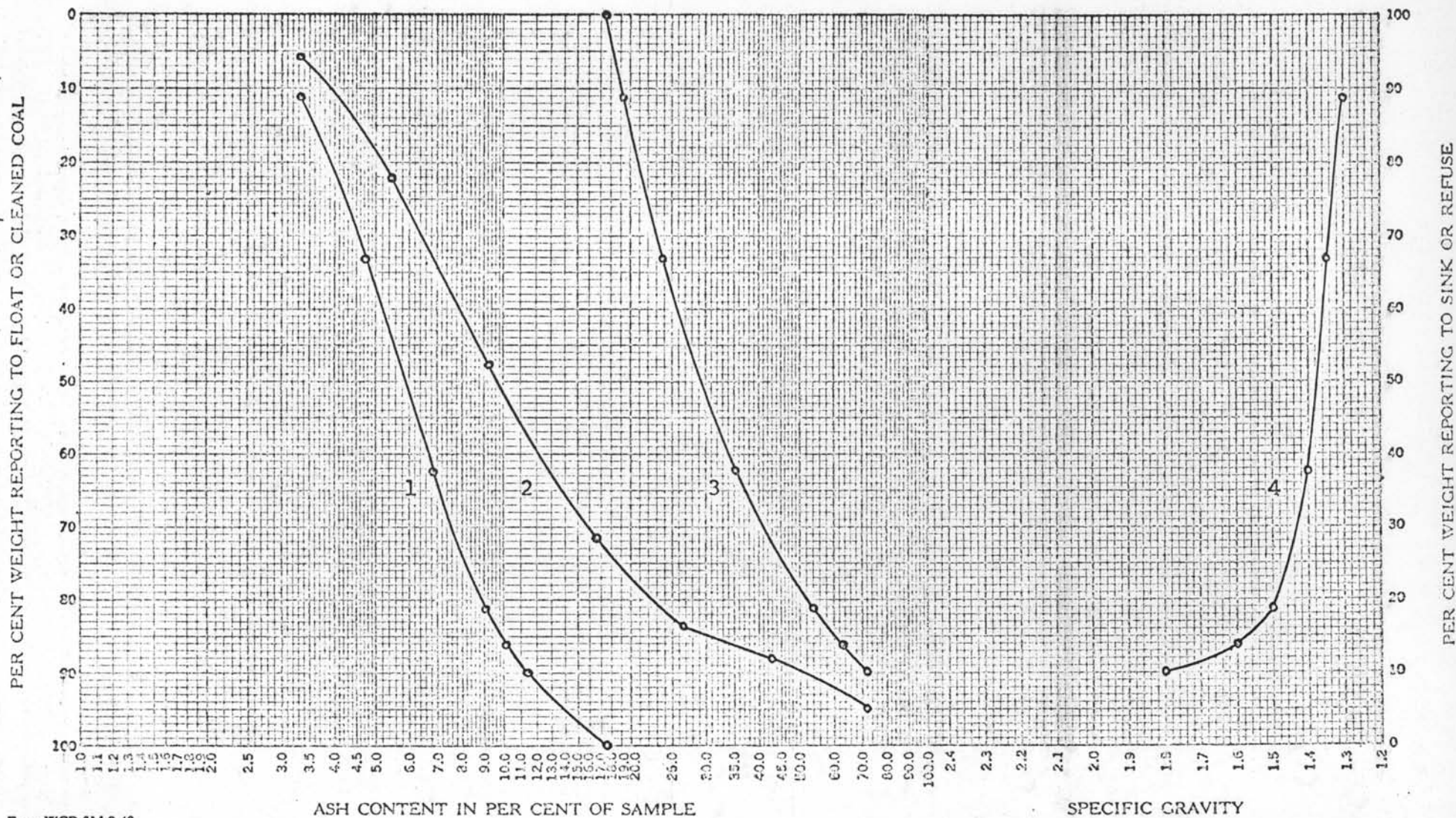
Charleston, W. Va.

Terre Haute, Ind.

CURVE LEGEND

- 1 Cumulative Coal-Ash
- 2 Coal Characteristic
- 3 Cumulative Refuse-Ash
- 4 Yield-Specific Gravity
- 5 Separation Effected

WASHABILITY CURVES



Crow's Nest Industries, Ltd.
Fernie, British Columbia
FERNIE #9

CH 379429 - CH 379435

February 12, 1970

1/4" X 28 Mesh = 30.8% of Total Seam Crushed to 2" X 0

COMMERCIAL TESTING & ENGINEERING CO.



SPECIFIC GRAVITY		DRY BASIS				CUMULATIVE RECOVERY (Float)				CUMULATIVE REJECT (Sink)			
Sink	Float	% Wt.	% Ash	% Sul.	% Vol.	% Wt.	% Ash	% Sul.	% Vol.	% Wt.	% Ash	% Sul.	% Vol.
	1.30	25.0	1.68	0.53	24.41	25.0	1.68	0.53	24.41	100.0	13.20	0.50	20.21
1.30	1.35	27.3	4.93	0.51	21.35	52.3	3.38	0.52	22.81	75.0	17.04	0.49	18.81
1.35	1.40	17.5	8.74	0.48	18.73	69.8	4.72	0.51	21.79	47.7	23.97	0.48	17.36
1.40	1.50	16.4	15.87	0.46	18.53	86.2	6.84	0.50	21.17	30.2	32.80	0.48	16.56
1.50	1.60	3.4	27.49	0.44	17.05	89.6	7.63	0.50	21.01	13.8	52.92	0.50	14.22
1.60	1.80	2.6	41.04	0.55	16.07	92.2	8.57	0.50	20.87	10.4	61.23	0.52	13.30
1.80		7.8	67.96	0.51	12.37	100.0	13.20	0.50	20.21	7.8	67.96	0.51	12.37

FREE SWELLING INDEX

<u>1.30 Fl.</u>	<u>1.30-1.35</u>	<u>1.35-1.40</u>	<u>1.40-1.45</u>	<u>1.45-1.50</u>	<u>1.50-1.60</u>	<u>1.60-1.80</u>	<u>1.80 Sink</u>
8-1/2	6-1/2	1	1	1	1	1	1/2

Job Crows Nest Ind. Ltd.
 Lab. No. CH379429-CH379435
 Mine Fernie #9 Seam
 Size 1/4" X 28 Mesh
 Raw Coal Ash 13.20%
 Raw Coal Sul. 0.50%

Commercial Testing & Engineering Co.

CONSULTING FUEL ENGINEERS
AND CHEMISTS

CHICAGO, ILL.

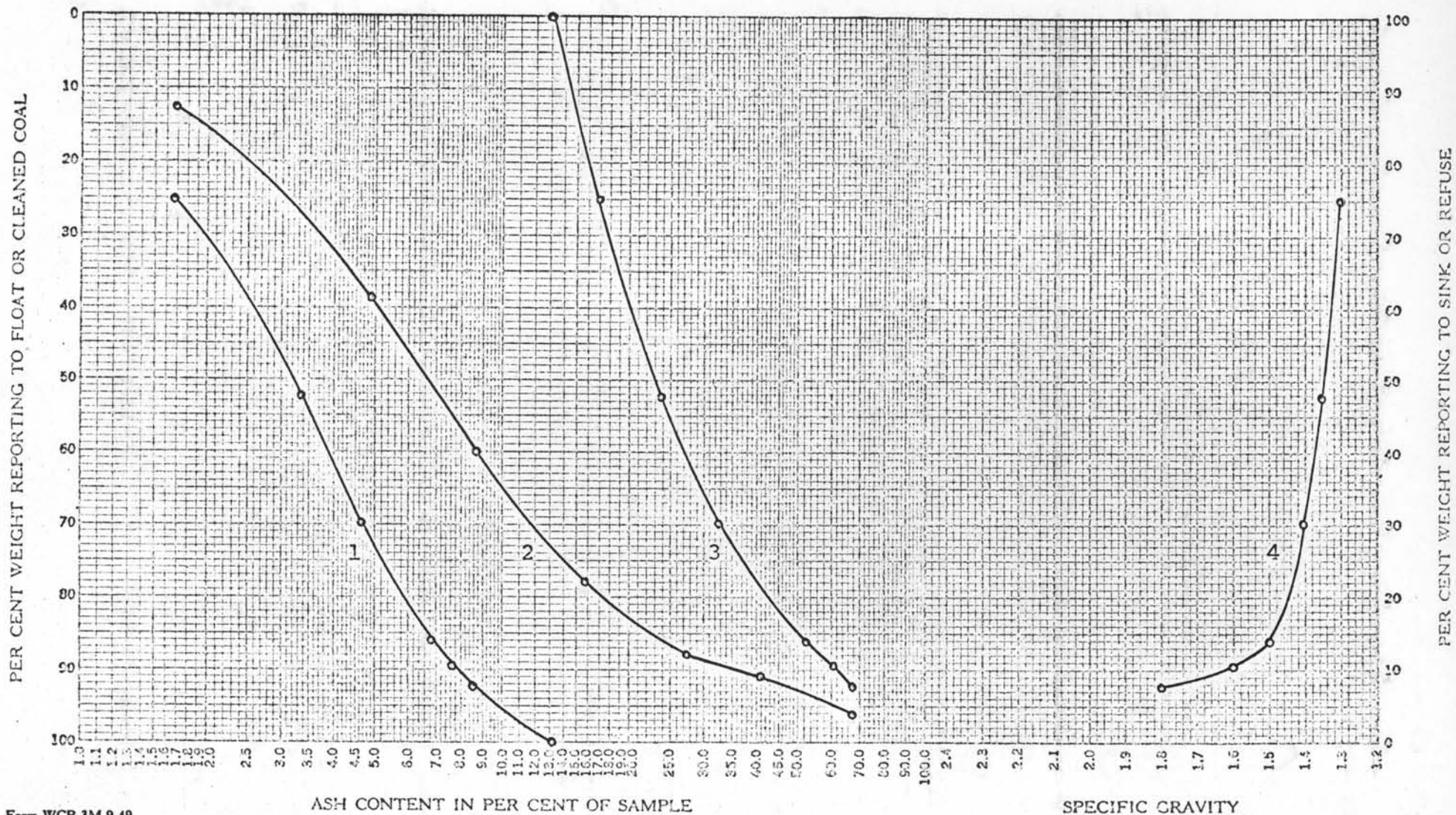
Charleston, W. Va.

Terre Haute, Ind.

CURVE LEGEND

- 1 Cumulative Coal-Ash
- 2 Coal Characteristic
- 3 Cumulative Refuse-Ash
- 4 Yield-Specific Gravity
- 5 Separation Effected

WASHABILITY CURVES



Crows Nest Industries Ltd.
 Fernie, British Columbia
 FERNIE #9

CH 379438

February 12, 1970

28 Mesh X 0 = 10.8% of Total Seam Crushed 2" X 0

FROTH FLOTATION

- Conditioning time 5 Min., MIBC 1 Drop,
 Kerosene 1 Drop

FROTH	DRY BASIS				CUMULATIVE RECOVERY				FREE SWELLING INDEX
	% Wt.	% Ash	% Sul.	% Vol.	% Wt.	% Ash	% Sul.	% Vol.	
	84.6	7.55	0.43	20.83	86.4	7.55	0.43	20.83	6
Fail-ings	13.6	36.04	0.66	16.66	100.0	11.42	0.46	20.26	1

COMMERCIAL TESTING & ENGINEERING CO.

Crows Nest Industries, Ltd.
Fernie, British Columbia

Fernie No. 9 Seam
Tumbler Test

Retained on	Passing	Weight Per Cent (1)	Average of Sieve Openings Inches (2)	Sieve Factor (3)	Prod. of (1 X 3)
SAMPLE					
1.06 In.	1.50 In.	100.0	1.280	1	100.00=S
TUMBLER COAL					
1.06 In.	1.50 In.	21.9	1.280	1	21.9
0.750 In.	1.06 In.	33.1	0.905	0.7	23.17
0.530 In.	0.750 In.	14.9	0.640	0.5	7.45
0.375 In.	0.530 In.	1.1	0.452	0.35	0.39
0.0469 In.	0.375 In.	2.6	0.211	0.16	0.416
0.0117 In.	0.0469 In.	3.9	0.029	0.023	0.083
	0.0117 In.	22.5	0.006	0.005	0.113
Total (Sum of Products (1) X (3) for tumbled coal - - - - -					-53.53
Friability, per cent, $\frac{100(100-53.53)}{100} = 46.5$					



RESULTS OF TESTWORK DONE BY OTTAWA
(METALS REDUCTION AND ENERGY CENTRE)

(ADVANCE SAMPLES)

SAMPLE

SEAM	8	8	8	8	9	9
ADIT	7	7	8	8	4	4
Raw = R						
Washed = W	R	W	R	W	R	W
<u>CLASSIFICATION</u>						
Specific Vol. Index	193	194	178	185	206	198
Vol. Matter (dmmf) %	22.4	23.4	23.4	22.4	21.2	21.4
<u>PROXIMATE ANALYSIS (db) %</u>						
Ash	15.2	7.9	15.4	6.9	11.0	8.6
Volatile Matter	20.1	21.2	20.8	21.4	19.7	20.2
Fixed Carbon	64.7	70.9	63.8	71.7	69.3	71.2
<u>GROSS CALORIFIC VALUE</u>						
BTU/LB. (dmmf)	15,570	15,650	15,260	15,410	15,670	15,640
Sulphur	0.43	0.36	0.25	0.31	0.32	0.36

RESULTS OF TESTWORK DONE BY OTTAWA (METALS REDUCTION AND ENERGY CENTRE).

C A R B O N I Z A T I O N

SEAM 9 ADIT 4

	<u>100% No. 9</u>	<u>30% No. 9 70% Powellton</u> *
Charge Wgt. (W) lbs.	517.0	517.3
Moist. in charge	3.6	3.2
A.S.T.M. B.D. #/ft ³	48.5	48.6
Lbs. Coal (DB)/ft ³	50.6	50.9
Coking time	9.40	9.50
K.W.H./Lb Coke	0.99	1.13
Coke Yield % Actual	80.6	73.7
Max. Wall Press.	0.46	0.59
 <u>Coke Size Dist.</u>		
3"	13.2	8.8
2"	54.6	53.0
1½"	78.6	79.4
1"	92.4	92.6
¾"	95.0	94.6
½"	95.5	95.2
 <u>Coke Parameters</u>		
% Breeze (-1/2")	4.5	4.8
Mean Coke Size	2.14	2.09
Apparent Specific Gravity	0.849	0.887
 <u>Tumbler Tests</u>		
ASTM Stability	49.2	49.2
Hardness	71.8	69.3
JIS 50 MM	8.6	10.5
25 MM	82.6	82.5
15 MM	91.8	91.7

* U.S. Standard H.V. Coal

Proximate analysis of the washed advance samples of No. 9 used

for the above coke oven feed went:

Ash	8.4%
Volatile	20.2%
Fixed Carbon	71.2%
Gross Calorific Value	15,640
BTU /Lb. (dmmf)	
Sulphur	0.36