REPORT

ON

THE COAL HOLDINGS

OF

SUQUASH COLLIERIES LIMITED

AT

SUQUASH

VANCOUVER ISLAND, BRITISH COLUMBIA,

CANADA.

****

Hope Engineering Limited

Vancouver B. C.

Canada

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HOPE ENGINEERING LIMITED
ENGINEERS - MANAGERS
STOCK EXCHANGE BUILDING VANCOUVER 1, B. C. TELEPHONE TATLOW 2351

Suquash Collieries, Limited,
1007 Stock Exchange Building
Vancouver 1, British Columbia

Attention Mr. H. C. Ketcheson, Pres.

REPORT
ON THE COAL HOLDINGS OF
SUQUASH COLLIERIES LIMITED

At your request we have made an investigation of the coal measures, now held under license by you, to determine the possibility of profitably developing them.

We have also considered the adjacent deposits which you may find desirable to acquire and develop.

Location

The measures under consideration are located on the northern end of Vancouver Island between Port McNeill and Port Hardy.

Description of Seams

There is a seam of coal at the 170 ft. level on which we have definite information and which forms the deposit under consideration in this report. It

has been stated, however, that there are other coal seams at various depths below the 170 ft. level the value of which can be determined by future exploration.

Our suggested plan of operation for the present involves only the seam at the 170 ft. level, although other seams below this probably can be mined under the same general plan of operation as soon as reliable information is obtained showing that it will be profitable.

The seam at the 170 ft. level appears to have an average thickness of about six feet and is relatively flat, with a slight pitch toward the north. Our investigation leads us to believe that there is sufficient coal in this seam now held under present licenses to produce an average of 500,000 tons of marketable coal per year for a period in excess of 45 years.

Type of Mining

Due to the flatness of the seam and the generally favorable type of ceiling and floor, conditions appear to be well suited to the use of mobile rubber tired mining equipment and we have, therefore, assumed the use of this type of equipment.

Probable Market

Our investigation indicates that there is a conceivable market for Suquash coal at the present time of about 1,800,000 tons per year. This market lies within an average distance of about 300 miles and can be reached by water transportation at an average rate of about $3.00 per ton.

We believe that the company should strive for the sale of coal to industries, under long term contracts. The Suquash coal is a good steam coal, is not friable, weathers well and is cheaper to prepare than miscellaneous sizes. This should receive the serious consideration of your management.

The following industrial and general customers are potential purchasers of Suquash coal.

Name	Location	Approximate Annual Requirements in tons of 2000.
Alaska Pine & Cellulose Co.	Port Alice	90,000.
B. C. Cement Co. Ltd.	Victoria B.C.	100,000.
Columbia Cellulose Co.	Prince Rupert	120,000.
Elk Falls Co. Ltd. (Pulp)	Duncan Bay	40,000.
General Industrial Users	Vancouver & Victoria	500,000.
New Bonneville Steam Plant		150,000.
Pacific Mills Ltd. (Pulp)	Howe Sound	30,000.

Pacific Mills Ltd. (Paper)	Ocean Falls	30,000.
Retail Coal	Vancouver	400,000.
Retail Coal	Victoria	100,000.
Seattle Central Heating Plt.		95,000.
Ship Bunkerage		150,000.
	Total	1,805,000. T

There also appears to be a market for export coal to Japan at present. Suquash should be in a favorable position to enter this market as Japan is now paying about $11.60 F.O.B. Seattle for Roslyn (Washington) coal of about the same quality as Suquash.

Present Prices

We have investigated the present price structure in Vancouver and Seattle, the largest general market points in the area, and determined that the retail prices for Vancouver Island coals range from about $19.70 for 13,000 B.T.U. Nut, to about $17.35 for about 12,000 B.T.U. Pea Stoker. On an equivalent B.T.U. basis Suquash should sell at the same price.

It is obviously impossible at this time to forecast the earnings which might accrue from the sale of Suquash coals of various sizes for various purposes and subject to various dealers "Spreads". It is possible,

however, to make a reasonably accurate estimate of earnings by assuming a wholesale price of $10.00 per ton for similar coal at Vancouver and Seattle. The present rate is about $11.00.

Favorable Depreciation Allowances

The Income Tax Laws of the Dominion of Canada are very liberal in their depreciation allowances for coal mines. With the exception of investments in wharves, docks and roadways, about 25% of the total investment may be retired in about three years and the remainder in five years.

Output Per Man Shift

We estimate the coal output per man shift for the type of mine recommended to be about as follows:

	Raw Coal	Processed Coal
	2800 T. per day	2000 T. per day
Underground Employees	20.0 - T	14.5 - T
Total "	14.8 - T	10.6 - T

Summary of Development Costs

We give below a summary of our costs of developing the mining property to produce an annual total of 500,000. tons of marketable coal if developed in accordance with the plan as outlined in the details of this report.

Portal Development	$ 110,000.
Underground Development	1,703,800.
Coal Transportation to Loading Terminal	775,000.
Washing & Processing Plant	325,000.
Loading Terminal & Equipment	410,000.
Steam Power Station	350,000.
Electrical, Transmission & Distribution System	150,000.
Water Supply System	140,000.
Housing Development	570,000.
	$4,533,800.
Organization, Engineering & Supervision 10%	453,380.
	$4,987,180.
Use	$5,000,000.

Operating Costs

We estimate the total cost of mining, processing, transportation to loading terminal and loading on water borne carriers; but not including depreciation or capital charges on an assumed annual production of 500,000 tons of marketable coal to be about as follows:

	Cost Per Year	Cost Per Ton
Labor	$ 710,300.	$1.42
Workmen's Compensation	40,163.	.08
Material & Supplies, Maintenance	240,000.	.48
Power	100,000.	.20
Royalties (British Columbia)	125,000.	.25
	$1,215,463.	$2.43
Administration	50,000.	.10
Insurance & Local Taxes	74,000.	.15
	$1,339,463.	$2.68
Operating Contingencies (15%)	200,000.	.40
Totals	$1,539,463.	$3.08

It is the present practice of industries and wholesale dealers to purchase coal F.O.B. mine and pay the freight charges.

An average realization price of $7.00 per ton F.O.B. mine, and an average freight charge of $3.00 per ton would equal the $10.00 per ton wholesale price assumed above. On the basis of 500,000 tons per year the annual income after operating costs would be about $2,000,000. or $4.00 per ton. This does not include depreciation or return on invested capital.

The above estimated realization is predicated on the basis that the property will be adequately financed, equipped as outlined in this report, properly engineered and operated by a competent organization throughout.

On the above basis we recommend its development.

Details upon which the foregoing recommendations are made will be found on the ensuing pages.

Yours very truly,

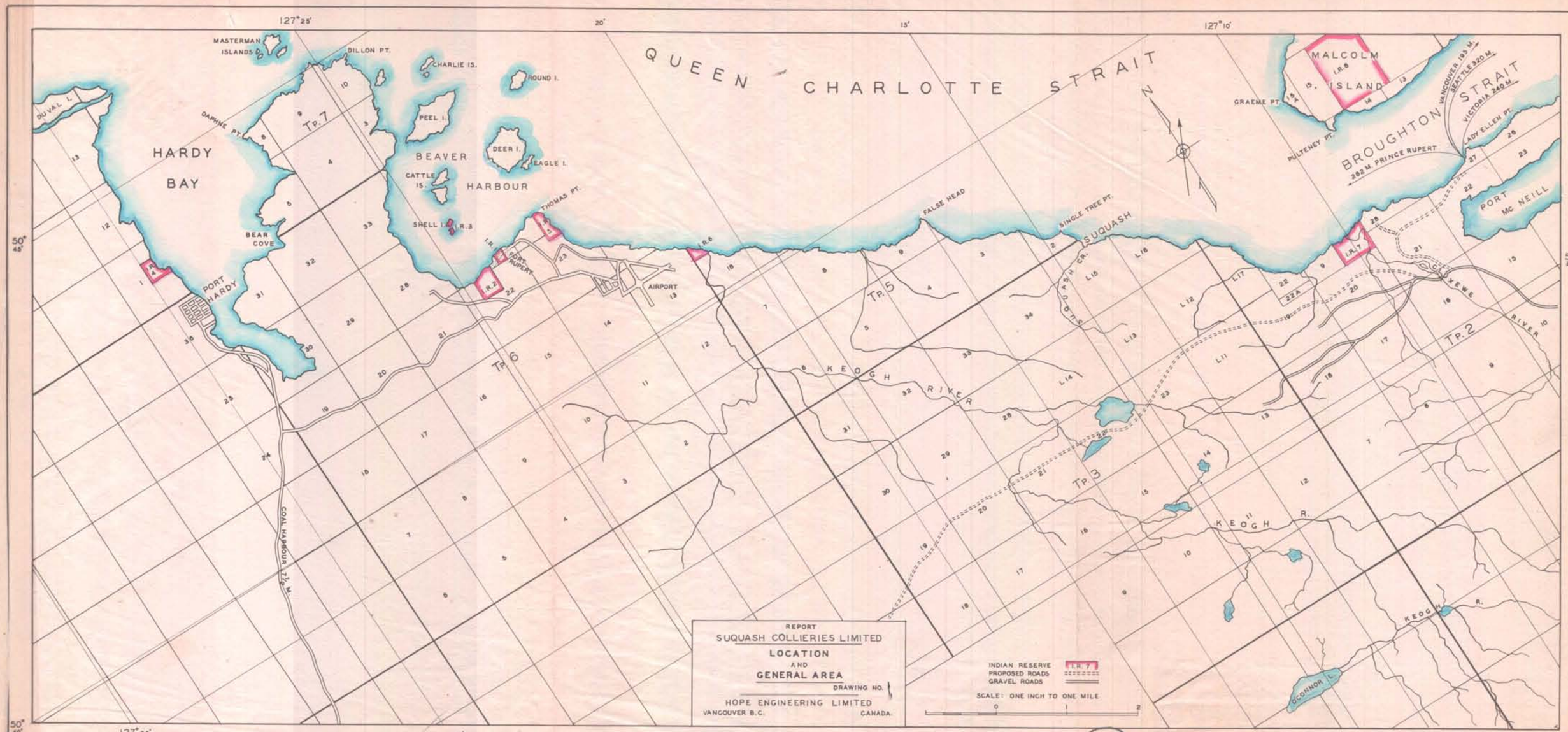
HOPE ENGINEERING LIMITED

Harry M. Hope

Harry M. Hope, P. Eng.
President

James E. Louttit

James E. Louttit, P. Eng.
Vice President



(MI) 00213 SQ-SUQUASH 52 (2)C

DRG. NO. 1

GENERAL DESCRIPTION OF PROJECT

At the beginning of our investigation several former underground workers at the Suquash mine were interviewed and considerable information as to the character of the workings, quality of the coal, etc, was secured. The files of the British Columbia Department of Mines at Victoria were also searched for recorded information.

Taken as a whole the information was rather incomplete and sketchy and not too reliable.

There were several facts, however, that all were in agreement on:

1. That the coal taken from the mine at that time was of good quality and a good steam coal;

2. That the roof and floor of the mine were practically level and consisted for the main part of sandstone with a slight pitch toward the northeast;

3. That the mine was a dry mine and required very little pumping.

A record of eight cut wall samples taken in 1922 was found which seemed to have been accurately made. These appeared to show a typical western coal, somewhat

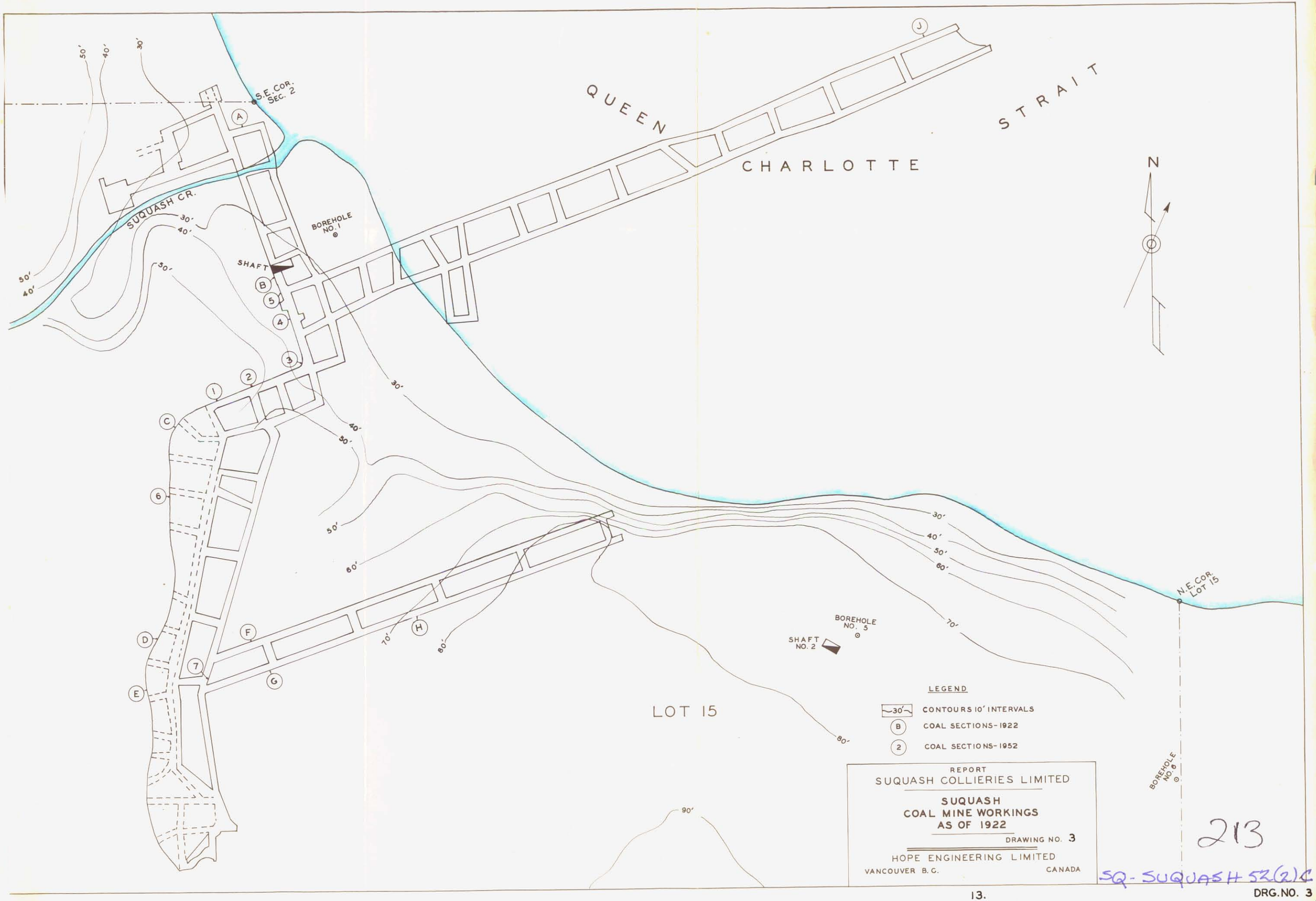
dirty, but not unusually so. (See Drawing No. 2, Page 12)

A proximate analysis of Suquash coal taken from Dowling's Memoir #69 "Coal Fields of British Columbia" (1915) is given on page 25.

Because of the necessity of securing more accurate data in connection with the coal deposit at the old Suquash mine, it was unwatered and a careful inspection made by us. New coal samples were taken and analyzed. (See Drawing No. 4) This Analysis Report is contained on pages 26 and 27.

An inspection made of the old workings revealed several cave-ins but these did not prevent the securing of the information necessary to determine the general conditions to be expected in a new mine located in the same vicinity.

Studies of the various factors involved indicate that the old mine could not be operated profitably and that a new mine in the vicinity of the old one should be constructed. The new mine should be a completely mechanized mine, with equipment of sufficient capacity to adequately supply the market at low operating costs. We believe that a mine producing 500,000 tons of marketable coal per year will meet these requirements and our studies and recommendations are based on a mine of this type and capacity.



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SQ-SUQUASH 52(2)C

Description of Plant: (Underground)

Indications are that, as in the case of the old mine, the roof and floor of the new mine will consist mainly of sandstone, therefore, we have assumed the use of mobile mechanical mining equipment, electrically driven and mounted on rubber tires.

To operate the mine on the retreating panel system, as we recommend and show in plan on Drawing No. 5; four operating units, each consisting of the following electrically operated equipment should be provided and worked as a complete unit:

1 - Rubber tired trackless loader.

2 - Rubber tired trackless shuttle cars.

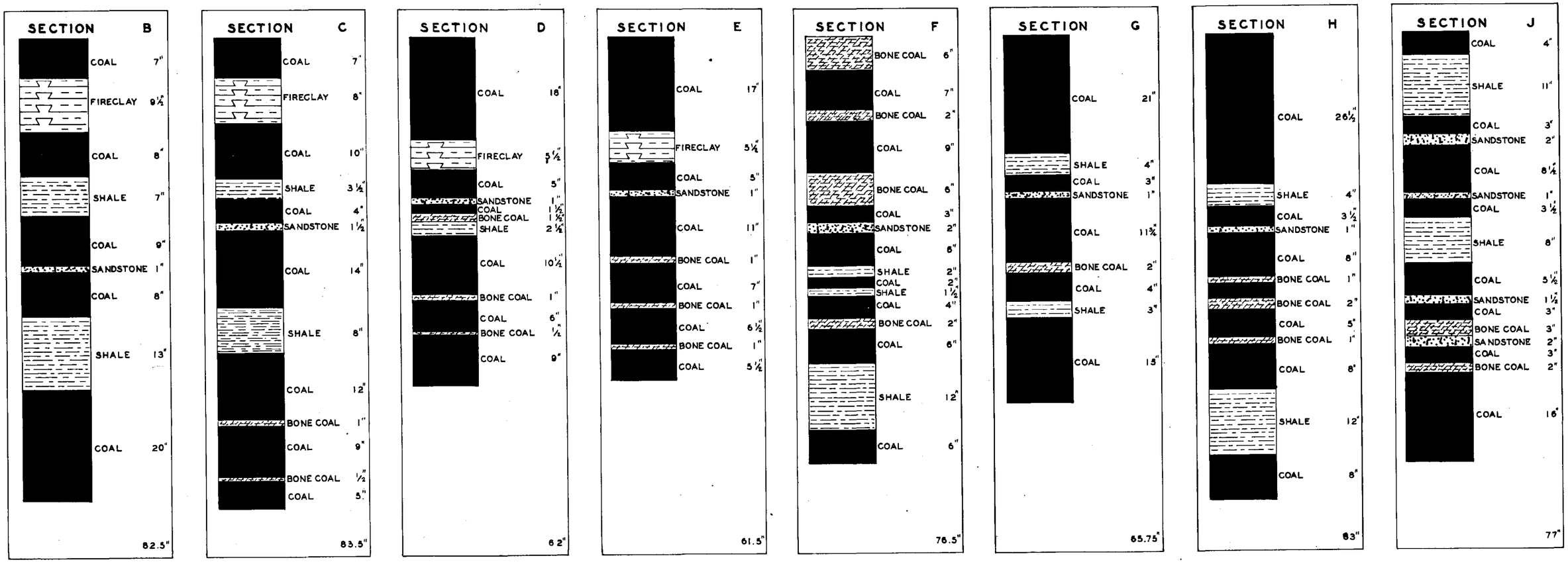
1 - Rubber tired trackless cutting machine.

1 - Rubber tired trackless coal drill.

1 - Car puller.

It is planned to gob the heavy partings underground and use them for roof support thus eliminating the necessity of handling them through the washing plant.

On this basis of operation, the four units should produce approximately 2800 tons of raw coal, minus heavy partings, per day of sixteen hours. This in turn will produce about 2000 tons of washed and prepared commercial coal per day or 500,000 tons per



SUMMARY

	TOTALS		AVERAGE		PERCENT	
COAL	423.25"	423.25"	52.9"	52.9"	71.4	71.4%
FIRECLAY	28.5"	169.5"	3.6"	21.2"	4.8	28.6%
SHALE	91.5"		11.4"		15.4	
SANDSTONE	15.0"		1.9"		2.6	
BONE COAL	34.5"		4.3"		5.8	
TOTAL		592.75"		74.1"	100%	

COAL 71.4%
WASTE 28.6%

REPORT
SUQUASH COLLIERIES LIMITED
COAL SECTIONS
ROOF TO FLOOR
CUT SAMPLES
1922
DRAWING NO. 2
HOPE ENGINEERING LIMITED
VANCOUVER B.C. CANADA

M2
213
SQ-SUQUASH 52(2)c.

SECTION No. 1.

COAL	7"
SANDSTONE	10½"
COAL	8"
SHALE	6"
COAL	1½"
SHALE	1½"
COAL	2½"
CLAY	1"
COAL	7"
BONE COAL	1"
COAL	4"
BONE COAL	1"
COAL	1½"
SHALE & ROCK	16"
COAL	20"

88½"

SECTION No. 2.

COAL	11½"
SANDSTONE	6½"
COAL	10"
SHALE	6½"
COAL	4½"
SHALE	1½"
COAL	12"
BONE COAL	1"
COAL	1½"
SHALE & ROCK	16"
COAL	11"

82"

SECTION No.3.

COAL	9"
SANDSTONE	10½"
COAL	10"
SHALE	7"
COAL	3"
SHALE	2"
COAL	10½"
BONE COAL	1"
COAL	2½"
SHALE & SANDSTONE	11"
COAL	12"

78½"

SECTION No. 4.

COAL	8"
SANDSTONE	14"
COAL	8"
SHALE	7½"
COAL	3½"
SHALE	2½"
COAL	13"
SHALE	5½"
COAL	2"
SHALE	2"
COAL	4"
BONE COAL	1"
COAL	7"
BONE COAL	1"
COAL	7"

86"

SECTION No. 5.

COAL	11½"
SANDSTONE	20"
COAL	10"
SHALE	6½"
COAL	3½"
CLAY	2½"
COAL	9½"
BONE COAL	1"
COAL	5½"
BONE COAL	7"
COAL	4½"

81½"

SECTION No. 6-A

COAL	7"
SANDSTONE	10"
COAL	9"
SHALE	5"
COAL	1½"
SHALE	1½"
COAL	3"
CLAY	1"
COAL	15"
SHALE & SANDSTONE	17"
COAL	21"
BONE COAL	3"

94"

SECTION No. 7

COAL	24"
SHALE	6"
COAL	4½"
SANDSTONE	1½"
COAL	11"
BONE COAL	2½"
COAL	4"
BONE COAL	2"
COAL	7"
BONE COAL	4½"
COAL	9"

76"

SUMMARY

	TOTALS		AVERAGE		PERCENT	
COAL	362.0"	362.0"	51.7"	51.7"	61.8	61.8%
CLAY	4.5"	224.5"	.7"	32.1"	.8	38.2%
SHALE	46.0"		6.6"		7.7	
SANDSTONE	144.5"		20.6"		24.6	
BONE COAL	29.5"		4.2"		5.0	
TOTAL		586.5"		83.8"		100%

COAL 61.8%

WASTE 38.2%

213 (M3)

REPORT

SUQUASH COLLIERIES LIMITED

COAL SECTIONS
ROOF TO FLOOR
CUT SAMPLES
1952

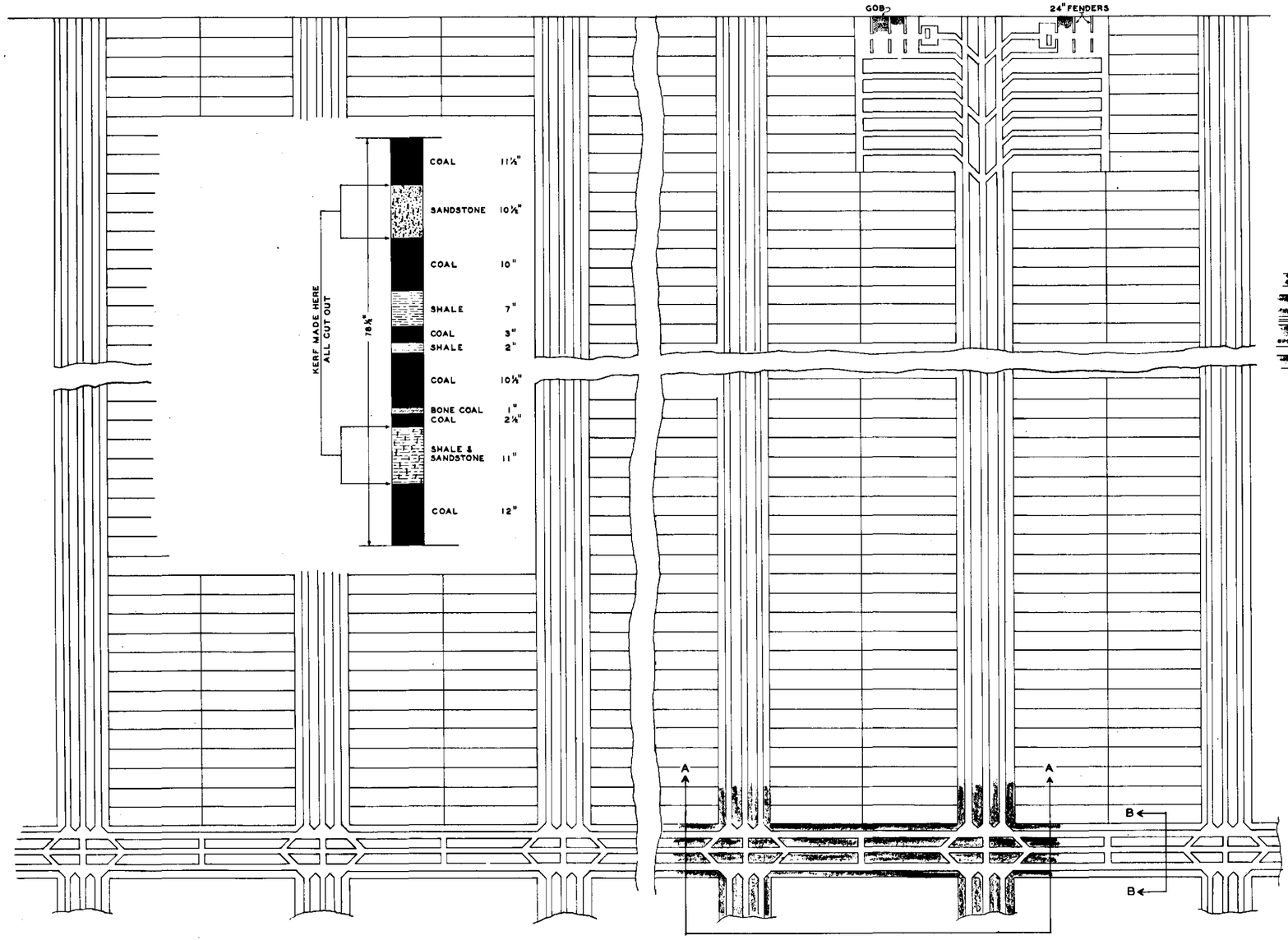
DRAWING NO. 4

HOPE ENGINEERING LIMITED

VANCOUVER B.C. CANADA

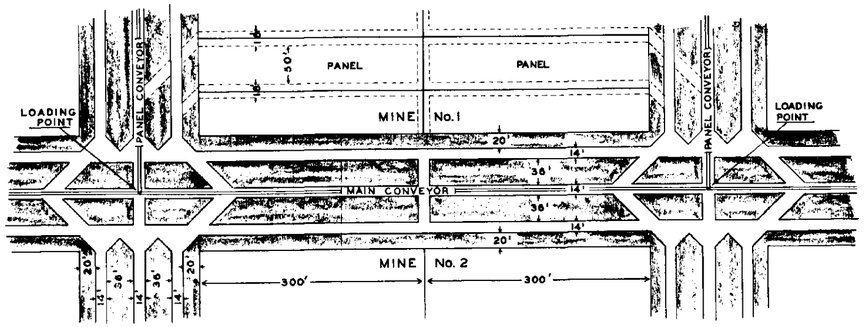
SQ SUQUASH 52(2)C.

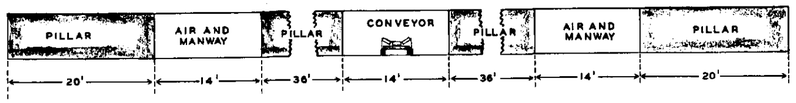
DRG NO 4



SECTION AT A-A

MAIN & PANEL ENTRIES
AND
HAULAGEWAYS





SECTION AT B-B

THRU MAIN & PANEL
HAULAGEWAYS - MAN & AIRWAYS

REPORT
SUQUASH COLLIERIES LIMITED
SUGGESTED
UNDERGROUND
MINE LAYOUT
DRAWING NO. 5
HOPE ENGINEERING LIMITED
VANCOUVER B.C. CANADA

M4

SQ-SUQUASH 52(2)Ca

DRG. NO. 5

year based on 250 working days.

It is proposed that all coal will be transported by electrically driven belt conveyors.

A main mine-entry slope will be constructed as shown on Drawing No. 6. Its exact location will be determined later. This slope will contain the main 36" slope belt conveyor with appurtenances. This conveyor will extend from the mine portal to the 170' coal seam and will carry the coal received from a 36" main underground entry belt to the washing and preparing plant at the mine portal. The main underground entry belt will receive coal from an initial installation of two 30" panel entry belts each fed from two of the operating units mentioned on page 15.

The main mine entry slope will also contain a 36" gauge 40# rail track with necessary cars for transporting men to and from the underground workings, as well as cars suitable for handling machinery and equipment. The cars will be operated from a 100 horsepower standard electric hoist located at the portal.

As required, 80 ft. from and parallel to the main entry slope, an air and manway slope will be installed. This air-manway slope will be the main access medium between the ventilating fan system located at the portal and the underground ventilating system.

Both slopes and equipment will be installed in accordance with the Regulations of the British Columbia Department of Mines.

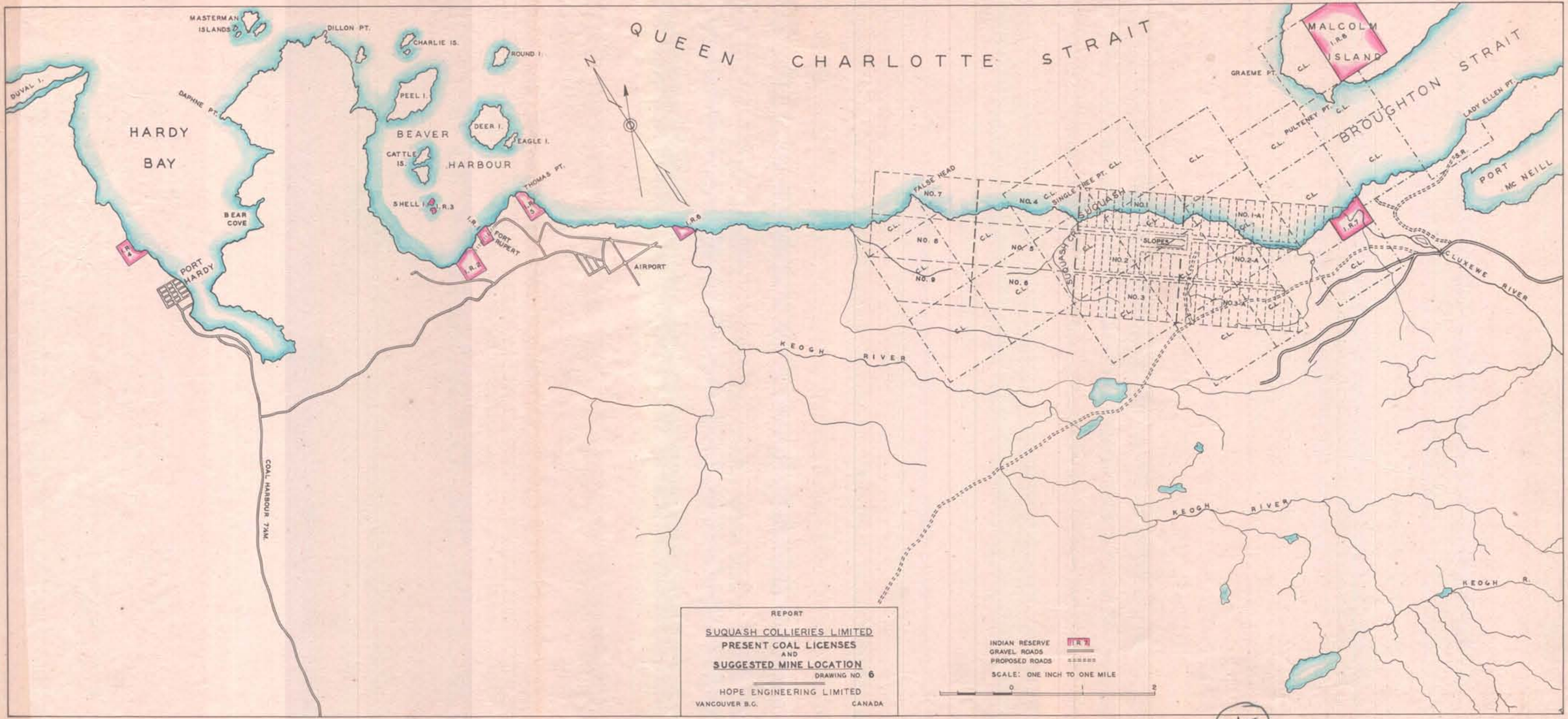
A storage battery or diesel locomotive of adequate capacity is to be provided to handle men and maintenance materials and supplies underground.

All underground wiring, transformers, safety circuit center equipment, motors, lighting fixtures, air regulating devices, etc, are to be of permissible design and installation as required by the Regulations of the Department of Mines.

Suitable pumping equipment will be provided. As the mining progresses it may prove advantageous to use a part of the old Suquash mine as a drainage sump and, by relining the present shaft, make it available as a ventilating shaft and escape-way.

Portal Development

The automatic coal washing and processing plant will be located at the Mine Portal, at which plant the Main Slope Conveyor Belt will terminate. Here the raw coal is received from underground, crushed, washed, screened, classified and loaded on the Long Distance Conveyor Belt System operating between the mine portal and the loading and storage terminal near Lady Ellen Point. This conveyor belt system will have a capacity



(M5)

SQ-SUQUASH 52(2)c.

DRG. NO. 6

of 3200 tons of processed coal per 16 hour day and be about 3½ miles long. The conveyor will consist of eleven "flights" of 24" wide belts with transfer chutes from one section to the other and will operate at a speed of 400 ft. per minute. The conveyor belt will be provided with a half oval corrugated steel cover with timber housing at the transfer points. The system will be supported on a timber structure about six feet above the ground and provided with an elevated walk-way on one side.

The Portal Development will also include the mine superintendent's office, repair shops, wash house, store house, timekeeper's office, first aid station, and mine ventilating fan and housing.

Loading Plant

A careful investigation of the foreshore of the island bordering Queen Charlotte Strait and Broughton Strait between Hardy Bay and Port McNeill has been made in order to select a suitable location for the loading plant.

Substantially, the entire shoreline between Thomas Point on Beaver Harbor and the mouth of the Cluxewe River was found to be a shallow rocky shelf which extends off shore for a half mile or more. Also this stretch is open and exposed to the elements. The

cost of the necessary shore developments anywhere between these points would be prohibitive. The only suitable location available lies on the shoreline in the small bay west of Lady Ellen Point. (See Drawing No. 7, Page 24.) At this location the wharf with its ship loading facilities and the coal storing and reclaiming system would be installed.

The loading and wharfage facilities contemplated would be adequate to load 10,500-ton ships as well as the necessary barges for coastwise haulage.

A surge bin would be installed as the terminal point of the Long Distance Conveyor System over which the finished coal is transported from the Processing Plant at the mine portal. From this point the coal would go either into Live Storage Stock Piles or be loaded into water borne carriers. All coal handling at the loading terminal would be by electrically driven belt conveyors with push-button control.

It is proposed to locate the general office and administration building at the loading terminal.

Employees' Housing Development

There are no living accommodations available within reasonable distance for the employees of Suquash, and it will be, therefore, necessary to supply them. It is proposed to construct adequate housing facilities

and other needed features at a Town Site near Lady Ellen Bay to house about 200 men and their families.

A sufficient number of five-room houses (in duplex) will be provided for the married men and bachelor quarters for the single men.

In addition, a recreation building, general store, and dining hall will be provided.

Power Generating Station

To furnish power to the entire project, a steam power plant, with a capacity of about 2000 KVA, will be erected on the west bank of the Cluxewe River at a point near Indian Reservation #7. This will be on the route of the Long Distance Conveyor Belt. (See Drawing No. 7, Page 24.)

Transmission of the power to the various distribution centers at the mine, the Town Site, and the loading terminal will be over a 3 phase - 13800 volt transmission line.

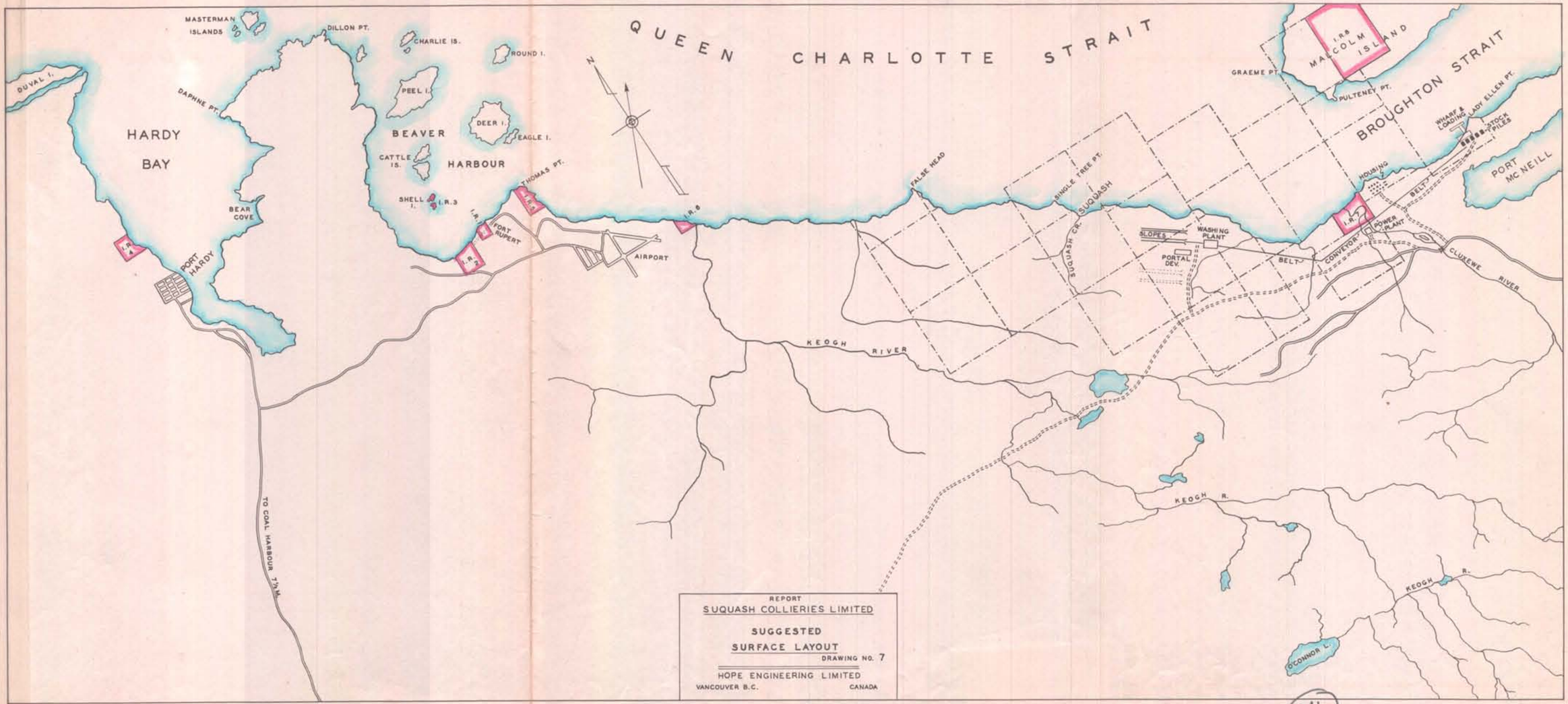
A 300 KVA-Diesel Engine driven unit should also be installed in the Power Station to provide power and light over the shut down periods, and as an emergency standby unit.

Several neighboring interests have indicated their need for power, hence it may prove expedient to increase the capacity of the generating plant to provide

extra power for "outside" consumption.

Water Supply System

Water for the entire project will be supplied from the Cluxewe River, through a 12" wood stave pipe line and a 100,000 gal. wood stave elevated tank. There is sufficient fall in the Cluxewe River to obtain ample pressure by gravity flow without pumping.



REPORT
SUQUASH COLLIERIES LIMITED

SUGGESTED
SURFACE LAYOUT
DRAWING NO. 7

HOPE ENGINEERING LIMITED
VANCOUVER B.C. CANADA

M6
24.

SQ-SUQUASH 52(2)C.

DRG.NO. 7

ANALYSES

The following are the available analyses of coals from the Suquash Area and the Nanaimo Area as shown in "Memoir 69, Coal Fields of British Columbia", by D. B. Dowling, 1915.

By comparison these analyses show the similarity of the coals of the two areas.

NANAIMO AREA

Proximate Analysis:	Wellington	Newcastle	Douglas
Moisture	1.1	1.9	1.54
Vol. Comb. Matter	39.3	39.4	37.7
Fixed Carbon	49.2	45.7	47.7
Ash	10.0	11.7	10.1

SUQUASH AREA

Proximate Analysis:	Klikaiwi River (Cluxewe)	Suquash	Kluk River (Keogh)
Moisture	3.65	5.03	3.68
Vol. Comb. Matter	42.23	41.51	39.29
Fixed Carbon	39.84	46.52	47.03
Ash	14.28	6.94	10.0

G. S. EILDRIDGE & CO. LTD.
and
Standard Testing Laboratories
633 Howe St.
Vancouver 1, B. C.

July 4, 1952

Suquash Collieries
1007 Stock Exchange Bldg.
Vancouver, B. C.

Dear Sirs:

We have tested the sample of COAL submitted by you and give below the following results:

Moisture	5.7%
Volatile Combustible Matter	36.2%
Fixed Carbon	47.1%
Ash	11.0%
Sulphur	0.98%

Calorific Value 11,580 B.T.U.'s per lb.

Respectfully submitted
G. S. EILDRIDGE & CO. LTD.
per R. H. McINTOSH

(This was a "grab sample" taken at the foot of the shaft at the 170' level.)

Department of Lands & Forests.
Victoria, British Columbia.
File 0173047 Lab. Sample 194-52

Sample Origin: Suquash Collieries.

Description: Channel sample of coal representing 47" in a total seam thickness of 78" on the 170' level. All heavy partings discarded.

Date Received: November 26, 1952.

Moisture retained at 99.9% Humidity:
Capacity Moisture..... % 9.0

PROXIMATE ANALYSIS:	As Recd.	Cap.Moist.	Dried
Moisture.....%	8.7	9.0	-
Ash.....%	9.0	9.0	9.8
Volatile Matter.....%	36.0	35.9	39.4
Fixed Carbon.....%	46.3	46.1	50.8
ULTIMATE ANALYSIS			
Sulphur.....%	0.4	0.4	0.4
Calorific Value Gross B. T. U. per lb.....	11200	11160	12260
Fuel Ratio (F.C./V.M.....	1.3		

Coking Properties:..... Agglomerating. Free Swelling Index 1½. Soft weak coke.

Remarks: Classification. High Volatile 'C' Bituminous.
M.M.Free. Dry F.C.%..... 56.9
M.M.Free No, BTU..... 12520
M.M.Free Dry, BTU..... 13760

Nov. 29, 1952

Signed.

K. C. Gilbart

G. S. ELDRIDGE & CO. LTD.
and
Standard Testing Laboratories
633 Howe St.
Vancouver 1, B. C.

March 12, 1953

Suquash Collieries
1007 Stock Exchange Bldg.
Vancouver, B. C.

Dear Sirs:

We have tested the sample of COAL submitted by you and give below the following results:

Moisture	7.6%
Volatile Combustible Matter	41.3%
Fixed Carbon	44.1%
Ash	7.0%

Calorific Value 11,840 B.T.U.'s per lb.

Respectfully submitted
G. S. ELDRIDGE & CO. LTD.
per R. H. McINTOSH

(This was a 20" cut sample taken from a showing on Suquash Creek)

FILE NO. 0188764 **COAL ANALYSIS REPORT** Lab. Sample No.
Coal Control 15-53

Department of Lands and Forests
Victoria, British Columbia

Sample Origin:	**Reported to:**
Suquash Collieries.	Hope Engineering Ltd.
	1007 Stock Exchange Bldg.
Location:	**Address:** 475 Howe Street
Vancouver Island.	Vancouver, B. C.

Description of Sample: Sample of coal marked Suquash Creek Surface Showing (old or upper seam). 20" coal in place. Sample consisted of about three pounds of crushed coal.

Sampler — Date of Sampling
Sampler's No. — Date Received March 16, 1953

Moisture Retained at 99.9% Humidity (capacity moisture)....%
Moisture Retained at 60.0% Humidity (air-dried moisture)...%

Proximate Analysis:		As Rec'd.	Cap. Moist	Dried
Moisture	%	6.5	8.2	
Ash	%	7.7	7.6	8.2
Volatile Matter	%	41.7	40.9	44.6
Fixed Carbon	%	44.1	43.3	47.2
Ultimate Analysis:				
Carbon	%			
Hydrogen	%			
Ash	%			
Sulphur	%	2.8	2.8	2.8
Nitrogen	%			
Oxygen	%			
Calorific Value gross B.T.U per lb.		12050	11820	12880

Coking Properties Coking. Poor Coke
Free swelling Index-1.(A.S.T.M.testD720-46)

Remarks: Classification: High volatile B. bituminous.
M. M. Free Dry F. C. % 52.0
M. M. Free Moist. B.T.U. 13050
M. M. Free Dry B.T.U. 14210

Coal probably weathered. Capacity moisture, calorific value classification may not be correct for unweathered coal.

Two pairs of coke buttons sent under separate cover.

Date March 25, 1953 Signed "K. C. Gilbart"

GRINDABILITY TEST

In addition to the foregoing analyses a report from the Bureau of Mines indicates that the results of Grindability Tests made by the Bureau on samples of Suquash coals taken from the 170' level showed a factor of 42.9 (Hardgrove).

This rating on the Hardgrove Index shows this coal to be relatively a very hard coal which means that in the handling, transporting, and shipping of the finished product a minimum of fines will result.

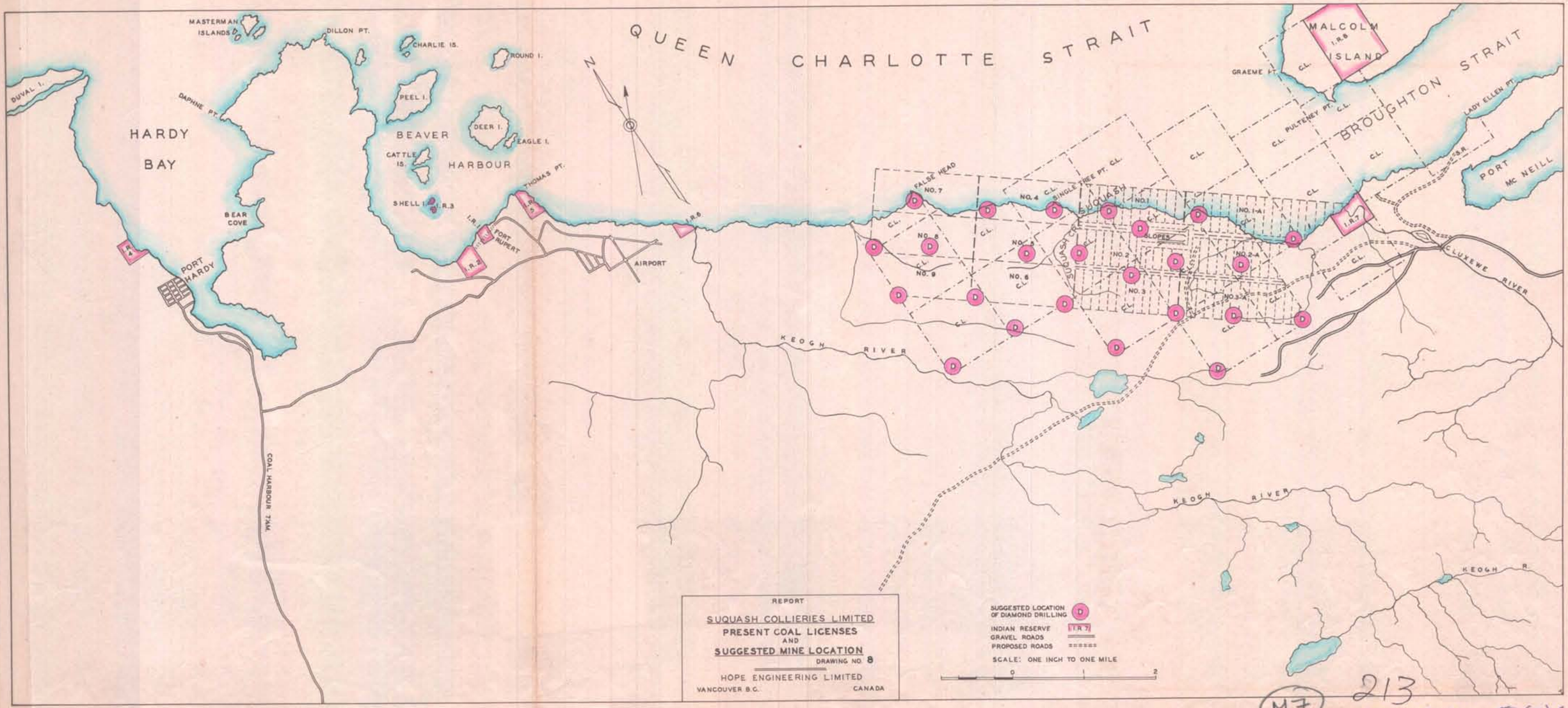
TEST BORINGS

Since the discovery of coal in the Suquash Area, various interests have purportedly made numerous test borings to determine the character of the coal and the seams for the location of their operations. The location of these test holes were scattered from Hardy Bay on the west to the Cluxewe River on the east.

With the exception of the few boring records we have been able to obtain, there seems to have been no attempt to preserve the data which must have been secured as the result of the various activities in this area. This early information apparently was available to mining engineers and other interested parties at the time, for those with whom we have discussed the matter were in general agreement as to the location, extent and quality of the deposit.

The location of the proposed mine and slopes as shown on Drawing No. 6, Page 18, is extremely tentative. It is our recommendation that construction of the slopes and other related work is started only after adequate core borings have been taken at the various locations as shown on Drawing No. 8, Page 33. The drill cores

should be not less than 2" and preferably 3" in diameter and should extend deep enough to determine the levels of the so-called 170' seam. Several of the borings should be carried down deep enough to establish the depth and extent of another seam or seams reported to exist below the 170' level.



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SQ-SUQUASH 52(2)C.

DRG. NO. 8

LOADING PLANT

The entire foreshore from Hardy Bay to the mouth of the Cluxewe River has been carefully inspected toward the construction of the Storage, Reclaiming and Shiploading system. Substantially, all of the shoreline between these points is not only extremely rugged with a shallow rocky shelf extending a half a mile or more off shore, but, it is also exposed to the sweep of the elements across the Queen Charlotte Strait.

The proposed location of the Wharf, Storage and Loading Facilities is in a reasonably sheltered bay to the West of Lady Ellen Point, off of Broughton Strait. Here the necessary deep water is available for ocean-going vessels to berth at the wharf which will contain the ship and barge loading facilities. (See Drawing No.7, Page 24.)

As previously stated the marketable coal (-6") will be transported from the Washing Plant by a belt conveyor to a 2000 ton Surge Bin, thence through 2 sizes of screens, minus 6" plus 2" and minus 2" plus 0", from where these sizes will be moved on cross belt conveyors to the Traveling Yard Stackers and into 10,000 ton Live

Storage Stock Piles.

Loading from these Live Storage Stock Piles will be on Tunnel and Outhaul Belt Conveyors to the Wharf Belt Conveyor which in turn will feed onto the Boom Traveling Ship Loader and into ships or barges. This loading system has a capacity of 400 tons per hour.

All four operations will have separate motors, brakes and switches with Push Button Control Stations all fully interlocked with other conveyors.

EMPLOYEES' HOUSING & TOWN SITE

As there are no living accommodations at all in the Suquash Area it will be necessary that a Town Site with all essential living accommodations and related structures be constructed to house and service the employees of the operation.

Because of the isolated location of the properties and also because of the estimated permanent mining operation, it is proposed that better-than-average houses and buildings be constructed. The economy in doing so lies in not only lengthening the building replacement time, and the upkeep and repair but also in offering the employees and their families better-than-average living quarters, a necessity in an operation as isolated as Suquash.

The suggested location of the Town Site is in Section 28, Twp. 2, lying to the east of Indian Reservation #7. (See Drawing No. 7, Page 24.) The site lies along the shore of Broughton Strait and it is not too far removed from the proposed location of the Steam Power Plant, thereby permitting the building heating and utility hot water to be drawn from the Power Station thus

eliminating the necessity of a separate heating and hot water plant or plants.

It is proposed to construct the following:

At least 30 duplex frame structures containing 2 5-room, 2-bedroom units each, a total of 60 5-room, 1-family units. These are to be equipped with ranges and refrigerators.

6 24-man dormitories to house single men or those unaccompanied by their families. These quarters will house 2 men to a room and are to be furnished.

1 dining hall of sufficient capacity to seat approximately 150 men at one setting, with a completely equipped kitchen and living quarters for one or two cooks.

1 large recreation building to service the religious, education and recreational requirements of the community.

1 large general store building.

The estimated cost of the foregoing includes the necessary clearing and grading; the construction of roads, streets and landscaping, as well as the necessary sanitary systems.

ESTIMATED COSTS

The following are the estimated costs of developing the mining property to produce an annual tonnage of 500,000 tons of clean, washed, marketable coal:

Portal Development		
Mine Superintendent's Office; Repair Shop; First Aid Station; Timekeeper's Office; Lamp room; Storehouse; Washhouse; Heating Plant; Ventilating Equipment; and etc:		$110,000.
Underground Development		
Main Slope	$300,000.	
Air & Manway Slope	163,000.	
Main Slope Belt Conveyor	78,500.	
Winch & Housing	10,000.	
Storage Battery or Diesel Locomotive	10,000.	
Track & Mine Cars	16,000.	
Main Entry Belt Conveyor	307,500.	
Panel Entry Belt Conveyors	200,000.	
Mobile Mining Equipment	533,000.	
Main & Exploration Pumps	10,000.	
Relining Old Shaft	5,800.	
Underground Wiring, Transformers, etc.	70,000.	
	$1,703,800.	$1,703,800.
	(Carried Forward)	$1,813,800.

	(Brought Forward)	$1,813,800.
Washing & Processing Plant at Portal		325,000.
Coal Transportation, Portal to Loading Terminal		
Main Conveyor, Belt, Equipment, etc.		775,000.
Loading Terminal & Equipment		
Storage Equipment, Loading conveyor Equipment, etc.	$250,000.	
Terminal Wharf	100,000.	
General Office & Administration Bldg.	30,000.	
Land Clearing, Road Construction	30,000.	
	$410,000.	410,000.
Steam Power Station		350,000.
Electrical Transmission & Distribution		150,000.
Water Supply System		140,000.
Town Site Development		
Employees' Houses, Dormitories, Dining Hall, Recreation Building, Store Buildings, Steam Plant, Miscellaneous Buildings, Clearing, Grading, Roads, Streets, etc.		570,000.
		$4,533,800.
Organization, Engineering & Supervision		453,380
		$4,987,180.

OPERATING COSTS

We estimate the total cost of mining, processing, transportation to loading terminal and loading on water borne carriers; but not including depreciation or capital charges on an assumed annual production of 500,000 tons of marketable coal to be about as follows:

	Cost Per Year	Cost Per Ton
Labor	$ 710,300.	$1.42
Workmen's Compensation	40,163.	.08
Material & Supplies, Maintenance	240,000.	.48
Power	100,000.	.20
Royalties (British Columbia)	125,000.	.25
	$1,215,463.	$2.43
Administration	50,000.	.10
Insurance & Local Taxes	74,000.	.15
	$1,339,463.	$2.68
Operating Contingencies (15%)	200,000.	.40
	$1,539,463.	$3.08

It is the present practice of industries and wholesale dealers to purchase coal F.O.B. mine and pay the freight charges.

An average realization price of $7.00 per ton F.O.B. mine, and an average freight charge of $3.00 per ton would equal the $10.00 per ton wholesale price assumed above. On the basis of 500,000 tons per year the annual income after operating costs would be about $2,000,000. or $4.00 per ton. This does not include depreciation or return on invested capital.

Present depreciation allowances for coal mines in the Dominion of Canada are as follows:

1. Wharves, docks. 5%
2. Vessels, boats, tugs, etc. 15%
3. Buildings - if situated on mine properties. 30%
4. Conveyor system, machinery equipment, plants, etc., (other than buildings). 20%
5. Roadways. 5%
6. Licenses - complete write off during lifetime of license. 100%
7. Depletion - 10¢ per ton for all coal mined & marketed.

FREIGHT RATES

Inquiry into the cost of transportation of coal from the loading plant at Ellen Bay indicate the following:

To Points North	Distance	Per Ton in 1600 T Lots
Prince Rupert	271	$3.14
Port Edward	271	3.13
Kitimat-Kemano	244	2.78
Ocean Falls	134	1.67
To Points South		
Port Mellon	190	2.27
Duncan Bay	89	1.40
Nanaimo	169	2.11
Powell River	122	1.70
Woodfibre	205	3.25
Victoria	235	2.64
Vancouver	195	2.27
New Westminster	195	2.60
To U. S. Ports		
Ketchikan	363	5.75
Port Angeles	254	2.99
Port Townsend	257	3.00
Bellingham	240	2.80
Everett	290	3.19
Seattle	294	3.35
Tacoma	316	3.40

VANCOUVER ISLAND COAL MINES

The 1951 Annual Report of the Minister of Mines for the Province of British Columbia lists the number of mines on Vancouver Island as 13. Of this number the following four mines operated by Canadian Collieries (Dunsmuir) Limited produced about 530,441 tons of raw coal in 1951 and the other nine mines 8,706 tons for the same period.

The 1951 production breakdown of the above four Canadian Collieries was reported as follows:

Canadian Collieries Mines

Comox Colliery (No. 8)	-	214,060 - Tons
Tsable River Colliery	-	120,568 - "
South Wellington #10	-	155,772 - "
Bright Mine	-	40,041 - "
Total	-	530,441 - "
All other mines	-	8,706 - "
Total for entire island	-	539,147 - Tons

The following indicates the relative tonnage of raw coal per man day produced by the four mines shown above when compared with the expected yield for the completely mechanized Suquash Mine.

	Total Employees	Underground Employees
Comox	2.15 T	2.67 T
Tsable River	3.31 "	3.68 "
South Wellington	5.82 "	7.50 "
Bright Mine	2.81 "	3.20 "
Suquash	14.8 "	20.00 "

No comparison is made with the other nine mines as they have only from 2 to 7 men each.

The three mines mentioned above required a total of 716 men to operate the mines to produce 530,441 tons of raw coal per year using 592 men underground.

The completely mechanized Suquash Mine is estimated to require only 189 men to produce 700,000 tons of raw coal per year using 138 men underground. Or, the above three mines required 3.8 times as many total employees and 4.3 times as many underground employees to produce 169,559 tons less coal per year as the estimated amount for the mechanized Suquash Mine.

We understand that the operation of the mines listed above have in some cases been discontinued and preparation is being made to shut down others as their operation is no longer profitable.

HISTORY

The history of the Suquash is a definite part of the discovery and production of coal from the areas adjacent to the so-called Western Inland Sea, the Puget Sound-Gulf of Georgia region.

Geographically, the United States-Canadian International Border separates the area into two more or less equal parts; the Puget Sound in the United States and the Gulf of Georgia in British Columbia; but geologically they follow a common seismic pattern of upheaval and subsidence and appear to have been laid down at about the same time.

The coal structures and rank vary greatly within the areas but historically the discovery and development of coal in the two areas are closely linked, one with the other.

Dr. W. F. Tolmie, Factor at the Hudson's Bay Post at Fort Vancouver (Oregon Territory) on the Columbia River, is generally credited with the discovery of coal in the State of Washington. In 1833 he described a coal deposit near the junction of the Cowlitz and Toutle Rivers in the vicinity of the present town of

Toledo, Washington.

Dr. Tolmie Stated, "The Indians came to the Post to trade. They told us how they used the 'burning rock' for their camp fires." He, having been familiar with the coals of the Old Country, traveled to the Cowlitz and made the report on the deposits he found there.

By 1835 Dr. Tolmie had been transferred as Chief Factor to the new Hudson's Bay Post at Victoria on Vancouver Island. At a northern Hudson's Bay Post on Vancouver Island, Indians were watching the Post's blacksmith working; his forge was stoked with coal brought around the Horn in sailing vessels. The "burning rock" looked familiar to the Indians and after biting and tasting it they told the blacksmith that there was the same kind of "burning rock" at a place called "Suquash", the Indian name for the beach where the squaws scraped the seal pelts brought in by the hunters.

The Post Factor sent word to Dr. Tolmie at Victoria regarding the purported Suquash coal and, Dr. Tolmie, in turn sent the Company's Steamer "Beaver" with Captain McNeil in command to investigate the coal deposit and the possibility of using the coal as fuel in the Company's Posts and steamers.

The Beaver anchored in what is now know as Beaver Harbour near Port Hardy, From where the Indians guided Captain McNeil to the coal exposed on the beach at Suquash. Captain McNeil reported that the surf had exposed a seam of coal several feet thick and that it lay between beds of sand stone. The coal was tested in the Beaver by Captain McNeil and reported as satisfactory. On the strength of his report measures were taken by Dr. Tolmie to establish not only a mine but a trading post and stockade in the vicinity.

Suquash was the first recorded discovery of coal in British Columbia, and, strangely enough, within a 2 year period, Dr. Tolmie recorded coal discoveries at both the northern and southern extremities of this now-known large area embracing Puget Sound and the Gulf of Georgia.

By 1846, no concerted effort to mine the coal at Suquash had been made, though a report in that year by a Peter Ogden and James Nash was to the effect that mining could be done at Suquash; that they had, with the aid of Indians using hatchets, dug some 90 tons of coal out of the beach exposures to be used as fuel in the posts and steam vessels.

During this period, British Naval vessels patrolling the coasts were using wood gathered along the shores,

together with some coal brought from England, as fuel. One of these vessels the "Cormorant" is reported to have anchored off Suquash and with the help of the Indians with their hatchets and canoes, the captain loaded some 62 tons of Suquash coal aboard his vessel. For "mining and transporting" this coal the Indians were paid 4 Shillings per ton and each received a string of beads.

The Hudson's Bay Post at Fort Rupert on Beaver Harbour was completed in 1849. The Victoria headquarters of the Company sent in some 40 men to work the coal at Suquash. These were followed by John Muir and a crew of miners imported by the Company from Scotland.

It is recorded that due to the unfriendly attitude of the Indians in the area, mining at Suquash during this period was, at its best, sketchy.

It was in 1849 that the first information regarding the coal deposits in the vicinity of Nanaimo and Newcastle was brought to the Hudson's Bay Factors at Victoria. Also, through reports brought in by Indians, Samuel Hancock reported the discovery of coal on the Stillaguamish River, east of what is now Arlington, Washington. In 1850 coal was discovered on the Skookumchuck River near what is now Centralia, Washington.

The year 1851 marked the advent of the Dunsmuirs. It was during this year that Robert Dunsmuir landed at Fort Rupert. While he was there word came of the new coal discovery at Nanaimo and he moved his activities to that area. Most of the miners employed by the Hudson's Bay Company at Suquash went with Dunsmuir to Nanaimo. By an order of the Chief Factor at Victoria operations ceased at Suquash in the latter months of 1852.

It was not until 1908 that any further effort to mine coal at Suquash was made. In the intervening years between 1852 and 1908 coal discoveries were made at Bellingham, Renton, Carbon River Canyon, Bucoda, Wilkinson, Cle Elum, Roslyn and other points in Washington. While on Vancouver Island new seams were located and opened at Wellington, Comox and Nanaimo. Also, coal discoveries were recorded on Queen Charlotte Island, and in the Crows Nest area in Alberta.

In 1908, Pacific Coast Mines, Ltd., started drilling operations at Suquash. No. 1, shaft was put down and the mine produced approximately 2000 tons annually during development, employing about 28 men. New equipment was brought in and development toward a large operation was started.

The advent of World War I, and the ensuing

shortage of materials and manpower reduced operations to such an extent that the mine was again shut down.

During the years 1916 through 1920, due to legal entanglements brought about by the shareholders of Pacific Coast Mines, Ltd., the mine at Suquash remained closed down.

In 1921 the mine was unwatered and further development was carried on, but by 1922, operating money gave out and the mine was again shut down.

In 1952, one hundred years after the discovery of coal at Suquash, the Suquash Collieries, Ltd., acquired the properties from the Provincial Government to whom the title had reverted. Hope Engineering Limited, Consulting Mining Engineers were retained to investigate the properties and report on the feasibility of economically producing the coal under modern mining methods.

GENERAL GEOLOGY

Vancouver Island, the largest island on the Pacific Coast of North America, is 280 miles in length and averages 50 miles in width. The greater portion of its surface is covered with the Vancouver Island Mountain Range.

The Outer Mountain Area, of which the Island Range is an integral part, is comprised of the Olympic Mountains, Vancouver Island Mountains, the Queen Charlotte Mountains, the Alaska Island Mountains, and the St. Elias Mountain group in Canada and Alaska.

This mountain area forms the western escarpment of the Canadian-North American continental land mass. They have a persistent front extending northwest-southeast.

The Outer Mountain Area is broken by the Straits of Juan de Fuca; the Queen Charlotte Sound depression; Dixon Entrance and other depressions as far north as Icy Straits in Alaska.

Paralleling the general strike line of this insular mountain series is what is known as the Coastal Trough, most of which in Canada is submerged beneath

the epicontinental sea of the Pacific. The Strait of Georgia depression in this trough is mainly submerged, but the parts that rise above the sea to the west are the shore lowlands on Vancouver Island and are of particular interest as it is here that the coals of the island are exposed.

On the south end of Vancouver Island this lowland shoreline averages 8 miles in width and is 100 miles or more in length with its center in the vicinity of Nanaimo. Only close to the mountains does this strip exceed more than 500 feet in elevation above sea level.

On the north end of Vancouver Island the mountain ranges end abruptly along an east west line through the mouth of Quatsino Sound on the west and through Port McNeill on the east side and forms a large basin of comparatively low elevation which encompasses all of the northern end of Vancouver Island.

This basin or area north of the break-off of the main Vancouver Island ranges consists of large patches of plains or plateaus separated by low rolling hills. The largest part of this area is well below the 1000 foot elevation line and does not exceed 3000 feet in elevation at its highest points. It is in the

southeastern portion of this Quatsino-Port McNeill area that the Suquash coal deposits are located.

Cunning (1930) in his work on the Buttle Lake area of Vancouver Island says that the rocks of the island are of three major groups. The oldest is an assemblage of volcanic rocks with some interbedded lime stone, argillite, and quartzite. That they vary in age from Palaeozoic to Triassic and possible Jurrassic or early Cretaceous age. These two older groups of rocks, overlain in part and unconformably by sandstones, shales, and conglomerates of Upper Cretaceous age, contain the important coal beds of Cumberland-Nanaimo vicinity.

Coal is found in the early Tertiary and in several of the divisions of the Cretaceous in various areas of British Columbia.

The Vancouver Island coals are therefore classified as Upper Cretaceous age and resting upon Jurrassic shales.

The coal beds in the Nanaimo-Comox area have been extensively studied and the conclusions of the geologists regarding these areas can well be applied to the Suquash coal series for they carry the same general characteristics.

Dowling states, "Little is known concerning the

actual origin of the coal seams, but since the coal measures were deposited under rapidly varying marine and terrestrial conditions, and since the seams rest indiscriminately on sandstone, shale and even conglomerates, there seldom being any under-clay and very few fossil roots, it is not probable that the coal is the result of accumulation of vegetable matter in large coastal plain swamps, with standing timber and luxuriant growth. It is more probable that the vegetable matter accumulated in peat bogs, which may have been formed in lagoons protected from the outer, marine basin by bay bars. It is quite possible therefore that the seams at Suquash do not extend indefinitely to the northeast below the strait as is the case in the Nanaimo area."

Dowling states further, "The coal seams are confined to a greater or less extent to the neighborhood of the old shore of the pre-Upper Cretaceous rocks. Since the seams, especially where undisturbed are dirty, the dirty coal alternating with clean coal, and in places are composed of dirty coal and carbonaceous shale, silt must have been deposited in the bogs with the peat, in sufficient amount in places to form some of the 'wants' of the present seams."

Dowling cites further, "In the Nanaimo area local deformation occurred while at least some of the

measures were unconsolidated, but the larger movements did not take place for a long period after the deposition had ceased. That the deformation was by forces acting from the northeast."

In the Suquash area the deformation forces were probably from the southeast or south. Minor disturbances or local variations or interruptions of the Suquash coal seams appear to have been formed in several different ways; by irregularities and deposition; by contemporaneous or later erosions.

In 1886 G. M. Dawson reported on the Suquash area and two divisions or areas lying east of Suquash which he called the Koskeemo area and the Quatsino Sound area.

Clapp reported on these areas in 1911.

Subsequently, in 1915, Dowling who had accompanied Dawson in 1886, compiled memoir 69 in which he quoted extracts from Dawson's report on these areas. In this report, Dowling assigns the coal fields of Nanaimo, Comox, Cowichan, Suquash and Quatsino coals to the Nanaimo formation. (See Analyses, Page 25.)

No new geological work was undertaken until the mapping in 1948 by the Ottawa Department of Mines and Resources, therefore, the data on the Suquash-Quatsino Sound area is confined for the main part to

Dawson's early report.

Many of the conclusions of Dawson and Dowling are verifiable on the ground today. Neither of these men had the advantage of studying numerous bore holes made in recent years nor had the underground work at Suquash mine been started at that time. Nor were these men able to penetrate very far westward from the Suquash shoreline, for even today the back country from Suquash is covered with an almost impenetrable undergrowth with many timber downfalls and numerous swamp areas. The logging roads which have been built recently and which are being extended throughout the area are of great advantage by giving greater access to the region west of Suquash.

The following are brief excerpts from Dawson's and Dowling's reports:

"The coast from Port McNeill to Beaver Harbor (14 miles) is occuppied by Cretaceous rocks, chiefly sandstones."

"Eel Reef near Port McNeill is of basalt, undoubtedly post-Cretaceous Miocene volcanic rocks, the only Tertiary rock met in the area."

"Ledge Point and Eel Reef are Cretaceous sandstones often shalely. Eel Reef bears S65°W. Rocks dip N25°W-10°. Fossils in some cases indicate a

slightly older horizon than the Production Measures of Comox and Nanaimo."

"From Ledge Point to Beaver Harbor the exposure is low, chiefly of sandstones and shale. The angles of dip seldom exceeding 10°."

"Coal at Suquash (upper seam only known at that time) is of two layers. The upper coal was one foot thick to two feet thick separated by a foot of soft shales on another layer of coal 6 inches thick." This coal is visible today by following Suquash Creek and studying the floor at low tide. (See Analysis, Page 29.)

Dawson found indications of coal on the Cluxewe River, a stream south of Suquash towards Port McNeill and states, "It is quite probable that the coals at Suquash represent a further continuation of the exposures on the Cluxewe."

"There is, however, at Suquash, a decided appearance of faulting and I am inclined to believe an extensive downthrow here occurs to the southward along an easterly and westerly line." (This surmise has been born out by an upthrust found underground at the present Suquash mine, a definite upthrust break of about 6 feet in the seam.)

Dawson further states, "On the above hypothesis the beds along the south of the Suquash are much newer

than those to the north, being entirely above the conglomerates and nearly equivalent to the lowest beds of the Nanaimo-Comox basins."

From observations made underground in the Suquash mine, it is believed that the age of the coal north and south of the upthrust is substantially the same. The character of the seam section has been altered somewhat by the disturbance in such manner that the seam to the south of the fault appears to contain a somewhat richer, cleaner coal, while that immediately north of the disturbance appears dirtier.

Dawson also develops a line of main faulting which bounds the south limits of the Koskeemo area and passes through Port McNeill on the east. "With an extensive downthrow to the north bounding the Cretaceous rocks in that direction, the Tertiary volcanic patch of Eel Reef may be in connection with this important fault." Dawson's conclusions are born out from evidence in the case of the Twin Peaks in Sections 9 and 17 of Township 2. These peaks are the farthest north intrusives into the Suquash coal area, and coal outcroppings were found by us to the east and west of the Peak in Section 17.

C. H. Clapp's report, which was made about the time the Pacific Coast Collieries Limited commenced

work at Suquash, contains some of the following statements. "Conditions in the Suquash field are somewhat similar to those of the Comox field.*** Several seams of coal occur in a gray siliceous sandstone resembling that of the Comox formation.*** Interbeds of shale in the Suquash sandstone are, however, thicker and more numerous, and are finer grained and more plastic.*** The structure of the measures is very regular and appears to be a broad syncline, striking about N60°E and pitching slightly to the northeast. The dips are low, less than 10°. There are several local rolls but no sharp ones. The measures are broken by a few faults or very small displacements. The coal seams are also very regular and do not pitch and swell as do those of the Nanaimo-Comox basin.*** As in the case of the Comox basin, the coal measures have been intruded by Tertiary volcanics, in the Suquash field by a trachyte porphyry."

Dawson and Dowling both considered the Quatsino Sound and Koskeemo areas as part of Suquash Cretaceous series and it was apparently sound reasoning. In bore holes and other early prospecting work in the Quatsino-Koskeemo areas, coal of commercial grade was not developed, but there appeared to have been indications of a coal series being present. It is felt that the Quatsino-

Koskeemo area does bound the western limits of the field at a greater elevation and should be taken into consideration as a possible future development.

Investigation of the area, and studies of the aerial maps of the entire section comprising the northern end of Vancouver Island leads to the conclusion that the coal bearing portion at Suquash can be likened to a segment of a saucer that has been broken across its center line or diameter. This break line is the eastern foreshore from Ledge Point (Port McNeill) on the south to Thomas Point (Beaver Harbor) on the north, a distance of 15 miles. This line of break is exposed to the sweep of Queen Charlotte Strait and has a general compass direction of northwest-southeast. (See Drawing No. 9.)

Eight miles north of Ledge Point and seven miles southeast of Thomas Point is the Suquash coal area. The old mine is practically in the center of the saucer-like area. Here is found an area of active faulting and upthrusts, perhaps some downthrows. This is to be expected because as the edges of the saucer shape were lifted on the northwest, the southeast and the western limits, the point of greatest strain was evidently centered at Suquash, or the middle point.

As stated previously the rocks of the Nanaimo-Comox production coal series are the Upper Cretaceous,

and the reasoning of previous geologists together with a study of the present physiography warrants a similar assumption for the Suquash-Quatsino area. Local conditions will modify conclusions to some extent but not in a major sense.

The Suquash-Quatsino area has undoubtedly been developed by the rapid erosion of sedimentary rocks of the Upper Cretaceous rocks which underlay the north end of the island, and presumably rests unconformably upon the resistant metamorphic and granitic rocks composing the Vancouver range. The Nanaimo and Suquash series consist of conglomerates, and are not uniform and in places they are partially consolidated, but in general are loosely held detritus of granite, quartz and feldspar; the shales are chiefly made up of detritus from the altered volcanic rocks. In places there are concentrations of hard, round pebbles and gravelly stones of porphyritic and volcanic rocks. On the beach at Suquash are many such rock forms.

It appears at Suquash that the coal series is partly of marine origin, since it was deposited on a surface of considerable relief and under varying conditions as can be seen by the rapid verticle and lateral gradations of the sediments.

It is also assumed that the coal deposits of

this series are mostly a fresh water accumulation and the position of the veins in relation to each other indicates terrestrial conditions must have alternated with marine conditions. Where the coal occurs in these upper formations they contain practically no marine organisms, so we assume the coal was laid down under terrestrial action.

Clapp, assumed the sedimentation began in the Upper Cretaceous first marine period, then uplifted 400 feet to its present position.

Due to the fact that a small coal seam is found along the beach at sea level, that a second seam has been opened up at 170 feet below sea level and that bore holes have produced evidence of a third seam several hundred feet below sea level we might assume that they may have risen and been subsequently depressed more than once. Also that terrestrial non-marine waters fed into bogs and depressions and spread over the shale or sandstone to lay down the matter that was eventually converted into carbonaceous layers of dirty coal and also a fair thicknesses of clean coal. Upheavels and pressure also altered the seam character, but there is every reason to believe that this entire Squash-Quatsino coal area was fairly evenly developed. The intrusives of a later age and their accompanying movement naturally broke

the field and even helped to alter the coal seam sections, but not as violently as apparently was the case at Nanaimo-Comox.

It is a reasonable assumption that when the ice mass from the Seymour Arch broke to the northwest, gouging out Johnson Straits and thence to the Queen Charlotte Strait, the shoreline from Ellen Point to Thomas Point was cut deep. If the coal series were shallow as indicated at Suquash, they were very materially eroded by the advancing ice.

Dawson and Dowling had claimed coal under Malcolm Island, but borings since their reports show mostly conglomerates with alternating shale and sandstone for a rather great depth on Malcolm Island. The bore hole at Pulteney Point shows only traces of carbonaceous shale with a few bands of coal of a maximum two foot thickness at 600 feet. The total depth of the bore hole there was approximately 1000 feet. Malcolm Island lies due north of Port McNeill and is separated from the mainland by Broughton Strait. It has a very low general elevation and the first three hundred feet of the bore hole shows nothing but clay, sand and gravel. It is more than likely that the coal shown at the 600 foot depth on Malcolm Island is a continuation of the coal at Suquash which is close to the surface at sea level.

From a study of the formation of the reefs off shore from Suquash there appears to be a shear-zone or faulting running parallel with the northwest-southeast strike of the shoreline. (Drawing No. 9, Page 67.)

On a line from Lone Tree Point, just north of Suquash, a reef strikes east and west along a well defined break, then there is a gap of fair depth beyond which an outer reef commences and bears on a northwest southeast line. This outer reef which is well exposed at low water mark is about 2100 feet from the shoreline at Suquash Creek and parallels the shore for an exposed length of approximately 2000 feet. There is another reef extending on an east west line from a point directly south of the old mine site which is also a part of this fault system. These three reefs form a lagoon off-shore from the mouth of Suquash Creek. The floor of the lagoon, which is traceable at low tide is of sandstone and rolls slightly to the north and south. Coal and coaly shale are visible on the sandstone to the lowest tide mark. This is apparently part of the upper seam that is exposed on the shoreline and at various points inland.

Regarding this possible off shore fault line, the outer reef paralleling the shoreline at Suquash, T. A. Rickard in an article published in 1928 cited a

similar condition at the Nanaimo Coal field:

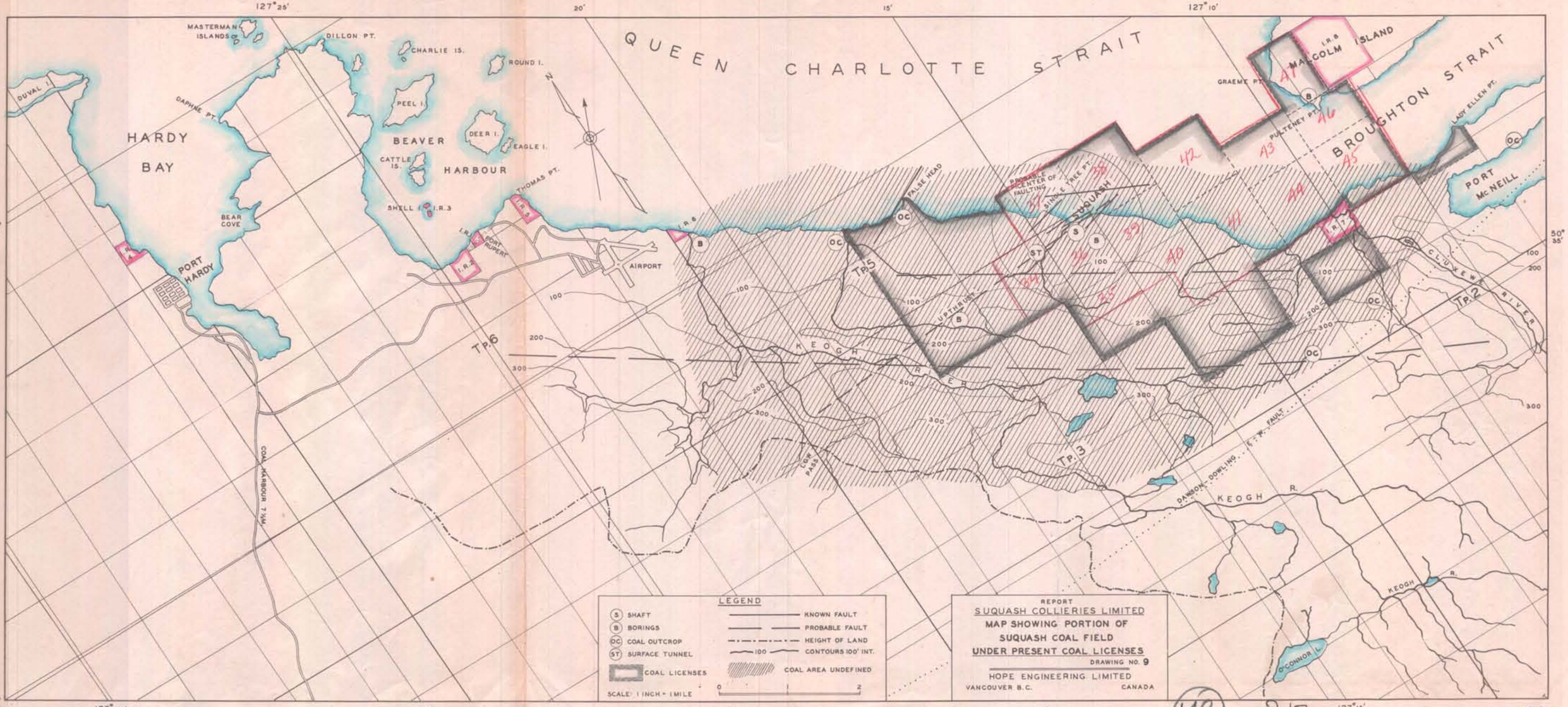
"The early development of the mines of the Nanaimo coal field indicate that the principal, or Douglas seam, dipped seaward, and when the line of the shore was reached it was found that a down throw fault of considerable displacement checked further exploration."

As previously mentioned, southeast from Sections 9 and 17, Tp. 2, are two well rounded intrusions, the Twin Peaks. These are from 900 to 1000 feet in elevation, and may have some bearing on the character of the coal in certain sections of the field. A fault line passes between these peaks and follows, in a northwesterly direction, the shallow valley containing the Keogh River and several shallow lakes. This fault line parallels the off shore fault line previously mentioned. There is also some evidence of a fault line approximately half-way between the Twin Peaks fault and the off-shore fault. This line would follow an extensive series of swamps directly back of Suquash. (Drawing No. 9, Page 67)

Large parts of this area are comparatively flat and the over burden is predominately gravel drift. In places this glacial drift of gravel, sand and clay is visible in steep banks up to 100 feet in height.

The entire Suquash coal area has an uneven deposition of from 100 to 300 feet of drift lying over

the upper coal series. In places this has been cut to less than 50 feet where streams have eroded to the shales overlying the coal sections, and in some places to the coal itself. This indicates that after further explorations, strip mining may be found to be economically feasible.



LEGEND

- (S) SHAFT
- (B) BORINGS
- (OC) COAL OUTCROP
- (ST) SURFACE TUNNEL
- COAL LICENSES
- KNOWN FAULT
- PROBABLE FAULT
- HEIGHT OF LAND
- 100 CONTOURS 100' INT.
- COAL AREA UNDEFINED

SCALE: 1 INCH = 1 MILE

REPORT

SUQUASH COLLIERIES LIMITED

MAP SHOWING PORTION OF SUQUASH COAL FIELD UNDER PRESENT COAL LICENSES

DRAWING NO. 9

HOPE ENGINEERING LIMITED

VANCOUVER B.C. CANADA

(MB) 213

67.

SQ-SUQUASH 52(2)C.

DRG. NO. 9

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