PAN OCEAN OIL LTD.

PINE PASS COAL PROJECT

NORTHEAST BRITISH COLUMBIA

1976 - 1977

PR-PINE PASS 77(1)A.

OPEN FILE

NTS 93-P-5, 93-O-8, 93-O-9

Coal Licences: 2910 - 2930, 2941 - 2952, 3560, 3562, 3565 - 3567, 3570 - 3591

Paul Dyson Consultants and Holdings Limited

Calgary, Alberta

December 1977

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Fig. 3 Cross-section - Proposed Adit site, Hasler Creek

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All above are in pocket

1. INTRODUCTION

This report describes the limited exploration completed on the Coal Licences of Pan Ocean Oil Ltd. in the Pine Pass area between January 1st, 1976 and December 31, 1977.

The exploration carried out in the field was limited to two attempts to locate a suitable site to drive an adit into the seam believed to have the most potential in the area. The procedures used, the drillholes completed and the cat work done are described in the report.

In addition to this work, two reports assessing the project were completed by consultants other than ourselves. These reports are:

(i) Conceptual Appraisal of the Pine Pass Coal Project by The Roberts Consulting Corporation January 1976.

(ii) An Evaluation of the Pine Pass Coal Property by Rescon Developments Co. Ltd. January 1976.

1. INTRODUCTION (Cont'd.)

These two reports were prepared for Pine Pass Development Ltd. who had at that time an option from Pan Ocean Oil Ltd. on the property. These reports are self-explanatory and we are enclosing them as Appendices A and B respectively.

2. EXPLORATION

Two attempts were made to locate a site from which an adit could be driven into the main prospective seam in the area (see Dyson, 1975). In this previous work it was concluded that "the primary objective of any additional work should be to establish without doubt the quality of the coal present in the low ash seam present in the Hasler Creek-Johnson Creek area". This seam had been penetrated in this area by drillholes 75-8, 75-9 and 75-10 (see Fig. 1).

2.1. Program #1 (May-July 1976)

It was decided that the optimum location for an adit site would be immediately adjacent to the main Hasler Creek Forestry Access road. Surface mapping indicated that a likely location for the seam crossing the road would be on Coal Licence 2941 immediately on the north side of the Hasler road. An angle hole, 76-11, was completed at a depth of 170 feet (52 m) and logged.

2.1. Program #1 (Cont'd.)

As can be seen from the lithologic log of this cored drillhole and from the geophysical logs a coal seam tentatively correlateable to the objective seam was penetrated. The geological configuration of the area was worked out and the Surface Sketch Map (Fig. 2) and Cross-Section (Fig. 3) were prepared.

Based on this a bulldozer was employed to trench the outcrop in an effort to locate the seam. Despite several days of trenching the seam was not located at surface either at road level or higher on the hillside above the road.

In some places the bulldozer found the till to exceed 30 feet (9 m) in thickness and bedrock was never reached. In the area believed most likely for the outcrop of the seam the bedrock was continuously exposed and no coal was found. Trenching adjacent to this area failed to reach bedrock and the attempt to locate an adit site was abandoned.

2.1. Program #1 (Cont'd.)

Two explanations are offered:

(a) the geology is more complex than realized and the seam penetrated in the drillhole is not continuous to surface.

or

(b) the structure is perhaps slightly steeper than postulated and the seam outcrop is covered by excessive till.

There is insufficient evidence to prefer one alternate over the other.

2.2. Program #2 (December 1976 - February 1977)

After failing to locate an adit site on Coal Licence 2941, a new attempt was made on Coal Licence 3570 approximately 800 metres northwest of drillhole ~~75-8~~. 75-9

A road was constructed mostly over a pre-existing trail from the Hasler Creek access road onto Coal Licence 3570. A coal seam was intercepted by the road near the northeast corner of the coal licence and preliminary stripping of

2.2. Program #2 (Cont'd.)

the outcrop indicated it to be similar to the objective seam. To verify this, two rotary holes, 77-1 and 77-2, with depths of 470 feet (143 m) and 300 feet (91 m) respectively were completed. While correlation of these two holes (see logs) was not totally certain it did appear that the exposed seam was probably the objective seam.

It was decided to prepare the adit site to have a 30 foot vertical rock face at the entry. While doing this, the bulldozer uncovered both faulting and folding in the coal seam. A suitable location for the adit no longer existed and further attempts to locate an adit site were abandoned.

3. RECLAMATION

The surface disturbance associated with Program #1 is totally reclaimed to the satisfaction of the B. C. Forest Service. Some minor reclamation is still to be completed in association with Program #2. This will be completed in 1978.

4. CONCLUSIONS

The need to obtain a bulk sample still remains. A program with a budget adequate to construct roads to structurally undisturbed areas, to carry out limited additional drilling and to obtain a bulk sample should be developed.

Surface mapping in the southeast area (Highhat River to Mink Creek) should also be completed.

December 1977

I. P. Dyson, P. Geol.

APPENDIX A

CONCEPTUAL APPRAISAL OF THE PINE PASS COAL PROJECT

THE ROBERTS CONSULTING CORPORATION

January 1976

CONCEPTUAL APPRAISAL

OF

PINE PASS COAL PROJECT

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CONCEPTUAL APPRAISAL OF PINE PASS COAL PROJECT

1.0 INTRODUCTION

The proposals set out in this report are the outcome of a concept developed from a review of the geological reports issued by Paul Dyson Consultants. They also reflect what is considered to be the most appropriate approach to the problems inherent in the Pine Pass area requiring the least financial exposure to the participants for the establishment of a viable mining operation.

2.0 PHILOSOPHY

The following points are relevent to the concept.

2.1 Approximately $600,000 has been spent to date on mapping and wildcat borings to determine structure and seam quality. The results indicate that the area is difficult to interpret geologically and that large areas are heavily distorted and have steep strata inclinations and faulting.

2.2 In such a situation similar wide spread investigations, while undoubtedly adding to the total information, are likely to continue to produce detail which is insufficient for any purpose other than general structural determination. The possibility that such work and expenditure will locate a more attractive area than that already known cannot be discounted but the chances of such an eventuality are considered to be remote especially when all the advantages of the Hasler Creek minesite location are evaluated.

2.3 From present knowledge it appears that there is no possibility of establishing a basis for a viable large scale mining operation producing plus 1,000,000 tons p.a. without extensive and costly drilling programmes having a low probability for success. Furthermore the total expenditure required by such a programme is unlikely to be forthcoming from any source at the present time particularly if the eventual operation is underground.

2.4 As a logical deduction therefore, further exploratory work should have as its objective the initial establishment of a small mine producing 300,000 tons p.a. capacity and entailing as little risk as possible both in exploration and subsequent mining development. The possibility of such a mine does exist in the area between Hasler and Johnsen Creeks. A proportion of the cash flow from the operation could then be used on further exploration and expansion of the project.

3.0 AREA REQUIRED FOR A SMALL MINE OPERATION

To establish a .3 million tons p.a. operation it is necessary to delineate reserves for a fifteen year operation. This would give sufficient time to repay capital and generate profits commensurate with the risk. It would also provide time for further exploration on other potential areas to permit the operation to expand or continue at the same level of production for a longer period.

3.1 The initial area is defined as follows:

Saleable coal 15 years at .3 million tons per annum	4,500,000
Production - assuming no washing	4,500,000
Average seam thickness between Hasler and Johnsen Creeks (assume only the lower seam is recovered)	15 feet
At an S.G. of 1.5 giving 93 lbs. per cu. ft. of coal in the solid the area required is	
$\frac{4,500,000 \times 2240}{15 \times 93 \times 9 \times 4840}$ =	166 acres

With a mining recovery set at 50% to allow for mining losses and no washery reject allowance, the total area required is only 332 acres.

4.0 DEFINITION OF AREA BOUNDARIES

According to Structural Cross Section G - G1 there is a flat top to the anticlinal structure 500 feet wide near borehole DDH 10. At Johnsen Creek the flat section of the anticline has a width of 1,800 feet - Section H - H1. The distance from a possible entry near the Hasler Creek mine to borehole DDH 75 - 10 is 3½ miles. Assuming the anticlinal structure is flattening to the North and that the average width of the flat section on the anticline crest is 1,200 feet, there is an area of 509 acres within these boundaries which is more than enough to satisfy the criteria defined in section 3.0. SEE PLAN I.

5.0 MINING METHODS

5.1 Longwall

An operation of the size proposed with the defined area could not justify the cost of longwall mining in capital expense or in the cost of the almost inevitable experimentation subsequently required to perfect the system. Therefore despite the ability of the system to negotiate the grades anticipated it is not considered to be a viable alternative.

5.2 Hydraulic Mining

Examination of the roof strata in the borehole logs indicates the overlying roof strata is sandstone to a height of at least 10 feet above the seam, thickening to 25 feet in the vicinity of borehole DDH 75 - 9. Thus the criteria desirable for hydraulic mining of good roof conditions, thick seams and grades over 7° appear to be satisfied. Should further geological information confirm the adoption of this system then a mine plan would be formulated according to the requirements of this system. It is possible that mine entries in Johnsen Creek might be justified if the overall long term advantages offset the initial increase in cost.

5.3 Continuous Mining

Should further exploration indicate sufficient reserves having a dip of 10 Deg. or less then continuous mining using a bord and pillar system has many advantages. The final selection of a system, or combination of systems would be made after further investigation. It is reasonably certain however that suitable face operations can be

conducted in the lower seam within the defined area. As the capital costs and productivity for both continuous mining and hydraulic mining are of the same order of magnitude it is not necessary at this stage to be specific. For the purposes of this report, continuous mining has been chosen to illustrate the cost structures likely to be encountered. Should hydraulic mining be the overall choice, the costs of production are likely to be less than those for continuous mining.

6.0 DEVELOPMENT PLAN

On the assumption that continuous mining would be the adopted system, the overall concept is described below.

6.1 A surface area would be cleared ajacent to the Hasler Creek Mine as shown on the plan. The outcrop would be exposed across the anticline of sufficient width to drive six headings along its axis - that is 500 feet of seam uncovered. The area immediately in front of this outcrop would be levelled and contoured for the surface facilities.

6.2 Two groups of three headings would be driven in the seam from the outcrop along the axis of the anticline providing intake and return airways as shown on Plan I. These headings would be extended to the maximum distance required and then the pillars would be taken on the retreat. The coal on either side of these main entries would be extracted to the maximum extent possible by the installation of panel conveyors. The face line would retreat gradually back to the portals if no other developments were undertaken.

If further development on the flanks was possible these main entries would be preserved intact for ventilation, transportation and men and materials access.

6.3 As illustrated in Plan II the underground equipment would be located for maximum versitility and efficiency. This plan is extremely simple and unsophisticated layout whereby the element of risk is minimised.

6.4 The mine planning would have always as its objective the exploitation of the maximum area with optimum production. At every stage the possibility of hydraulic mining on the steeper flanks would be evaluated to extend the development into areas where the steeper dips preclude the use of continuous miners.

6.5 The coal would be carried from the mine on trunk conveyor which would deliver directly into a crusher, screen and coal storage complex. Since the ash content is so low as to obviate the use of a coal preparation plant, the surface installations would be minimal.

6.6 From the coal storage bins the output would be carried by contract truck haulage to a siding located eight miles from the mine on the British Columbia Railway. Sidings and a rail loading facility would be constructed on this site.

6.7 Until such times as a bulk handling terminal is constructed at Prince Rupert, the coal would be shipped via Neptune Terminals in Vancouver.

7.0 FACTORS IN FAVOUR OF THE PROPOSED SCHEME

7.1 Low Capital Cost

This project has the potential of being the cheapest installation in Canada. No washing plant, no housing, short haul to rail, thick seams with simple mining system.

7.2 Employee Recruitment

The relatively close proximity of Chetwynd as a base gives this project a tremendous advantage over other developments scheduled in the area.

8.0 SURFACE FACILITIES REQUIRED

8.3.1 Power Supply

Connection to the B.C. Hydro supply would be most desirable and would be investigated. To our present knowledge there is no major difficulty in obtaining power from Hydro but if it should be impractical then local generation is a viable alternative.

8.3.2 Mine Dry - Bathroom

Bathing facilities for 100 men should be provided. There are a number of prefabricated units available which are relatively inexpensive and are entirely adequate.

8.3.3 Workshop And Store

Repair facilities for the day to day maintenance of machines must be provided together with a store containing an inventory of spares covering most frequently required parts.

8.3.4 Offices

Pre-fabricated units would be adequate to cover the clerical and administrative functions required at Colliery level.

8.3.5 Ventilation Fan, Mine Healer, Lamp Cabin

8.3.6 Storage areas are other normal requirements.

9.0 ECONOMIC ANALYSIS - OPERATING COSTS

9.1 Assumptions and Statistics

a). Saleable output 300,000 long tons p.a.

b) Analysis of product (see Report Vol. II Pages 66 and 78)

I.M.	1.9 - 1.4	
Ash	2.4 - 5.7	
V.M.	15.1 - 18.4	No preparation plant required
F.C.	80.6 - 74.5	
F.S.I.	½ - 2	

c) Mine will produce coal on 47 weeks per annum

d) Mine will produce coal on 5 days per week

e) Production shifts per day - 2

f) Continuous miner production units - 2

g) Production shifts per week - 10

h) Production per unit shift - 400 tons

i) Production per week - 8,000 tons

j) Production per annum - 376,000 tons

k) Labor force - 93 employees and staff

l) Hourly rate (average) - $8.00

m) Production bonus - $60.00 per week

n) Overtime 15% at time plus one half

9.2 Labour Requirements

The classifications stipulated are for the assumed continuous mining operation. This represents the likely maximum number of personnel required as the other alternative of hydraulic mining if properly applicable would not be as labour intensive.

9.2.1 Underground - Production and Maintenance

Category	Day Shift	Afternoon Shift	Night Shift	Total
Fire Bosses	2	2	2	6
Miner Operators	2	2	-	4
Timbermen	4	4	-	8
Shuttle Car Drivers	4	4	-	8
Conveyor Men	2	2	-	4
Supply Men	-	-	4	4
Mechanics	1	1	2	4
Electricians	1	1	2	4
General	2	2	2	6
	18	18	12	48

9.2.2 Surface

Lamp Cabin	1	1	-	2
First Aid & Bathroom	1	1	-	2
Coal Handling	2	2	-	4
Supplies	2	2	-	4
Mobile Equipment	2	2	1	5
	8	8	1	17

9.2.3 Maintenance - Surface Workshops and Plant

Mechanics	2	2	-	4
Electricians	2	2	-	4
Welders	1	1	-	2
	5	5	-	10

9.2.4 Administration

Category	Day Shift	Afternoon Shift	Night Shift	Total
Managers	1	-	-	1
Shift Bosses	1	1	1	3
Surveyors	2	-	-	2
Store Men	1	1	1	3
Training Officer & Personnel	1	1	-	2
Clerical	2	2	-	4
Gen. Surface Supt.	1	-	-	1
Mech. Engineer	1	-	-	1
Electrical Engineer	1	-	-	1
	11	5	2	18

9.3 Statistics

Total all employees - 93

Output per manshift - 17.2 tons

9.4 Production Costs - Weekly Basis

9.4.1 Labour

Award earning 65 x 8 x 40	20,800
Overtime 15%	3,120
Bonus	3,900
Staff	8,000
Fringe Benefits	7,000
	42,820

Labour cost per ton $5.35

9.4.2 Material Costs

Without historical data it is difficult to precisely estimate material costs for a particular operation. The figures given below are based on experience and general knowledge of the industry.

	Cost Per Ton
A) Face Materials	
Timber, roof bolts, brattice, vent tubes etc. Machine consumables, picks, oil, greases	1.15
B) Repairs and Maintenance Materials	
Machine parts, replacement of cables, conveyor parts, belting etc.	1.35
C) Major Overhauls	
Cost of major overhaul to all equipment on a two year cycle, estimated at 25% of new prices.	0.55
D) Mine Services	
Rock dusting, re-timbering roadways, bricks and concrete, general support.	0.25
E) Direct Shop Charges	
Cost of materials and services supplied to underground by the surface service department.	0.30
F) Electric Power	
Estimates cover unit power cost, maximum demand charges etc.	0.40
G) Mine Heating	
Propane consumption.	0.15
Material Cost Per Ton	4.15

10.0 UNDERGROUND EQUIPMENT COSTS

ITEM	UNIT COST MID 1975	NO.	TOTAL COST
Jeffrey Heliminer 120-H-1, 950u	354,000	2	708,000
Joy - 10 Sc 26 Shuttle Cars, 950u	76,700	4	306,800
Stamler Breaker - Feeder	55,500	2	111,000
Roof Bolting Machine - Fletcher	43,700		87,400
Aux. Ventilation Fans & Tubes	7,000	4	28,000
Transformers 750 KVA	40,600	2	81,200
Mining Section Switchgear	62,350	2	124,700
Trailing Cables Per Section	42,000	2	84,000
Conveyors - Trunk & Panel (including belt & accessories)			2,000,000
Transformers For Conveyors With Switchgear			160,000
Man Riding Vehicles	35,100	2	70,200
Pumps, Trickle Duster etc.	10,000	2	20,000
Supply Tractor & Trailers	36,000	2	72,000
H.T. Cable & Switchgear			100,000
Fire Fighting Equipment - Pipes			85,000
Mine Drainage - Pumps & Pipes			25,000
Main Roadway Rockduster	40,000	1	40,000
Telephones			30,000
Miscellaneous			150,000
			4,283,300
Replacement Capital - 7th Year (averaged out)			1,656,000

11.0 SURFACE EQUIPMENT AND FACILITIES

Power Supply and Switchgear	1,000,000
Mine Dry	150,000
Workshop and Store	150,000
Inventory	750,000
Offices	80,000
Ventilation Fan, Mine Heaters etc.	100,000
Screens and Storage Bins	350,000
Roads and Surface Earthworks	100,000
Upgrading Road to Siding	300,000
Siding Construction and Loading Facilities	750,000
Mobile Equipment	500,000
Miscellaneous	500,000
	$4,730,000

12.0 OPERATING COSTS - WEEKLY BASIS

Production - long tons (also sales tonnage)	8,000
Labour 5.38 x 8,000	42,800
Materials 4.15 x 8,000	33,200
Transportation and Rail loading	9,600
Labour Training $700 per man/year	1,400
Labour Turnover Cost	600
Administration, Consultancy etc.	2,000
Contingencies	10,000
	99,600

Cost per ton F.O.R. Pine Pass	12.45
Freight - Pine Pass to Neptune	12.00
Neptune - Loading charges	1.25
Royalties	1.50
Insurances etc.	.30
Sales, Head Office Charges	1.00
Cost per long ton F.O.B. Neptune	$28.50

13.0 MARKETING

For the purpose of estimating cash flows and an economic summary of the project a value has been conservatively fixed for the utilisation of this coal as a steam coal and also as a metallurgical blend.

13.1 Steam Coal

In comparison with Byron Creek exports and with current tenders accepted in Taiwan, the value of this coal for steam raising is estimated at $35.00 per long ton F.O.B. Vancouver.

13.2 Metallurgical Coal

Until the precise characteristics of the coal are known following coking tests it is more difficult to fix a realistic price for this coal as a metallurgical blend. However a reasonable figure would be $40.00 per long ton F.O.B. Vancouver.

14.0 DEVELOPMENT SCHEDULE AND PRE PRODUCTION COSTS

14.1	Pre 1976	
	Geological Exploration to date	600,000
14.2	January - December 1976	
	Further drilling required to determine structures along anticline axis. Support costs etc.	250,000
	Bulk Samples and exploration adit	150,000
	Assuming decision to proceed - further site preparation, engineering etc.	100,000
14.3	January - December 1977	
	Site preparation and installations Preliminary underground work pending delivery of equipment	250,000
14.4	January - June 1978	
	Installation and commissioning of equipment	250,000

Production commences June 1978

15.0 PRE PRODUCTION COST AND CAPITAL EXPENDITURE SCHEDULE

	Pre 1976	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Pre Production	600	500	250	250								
Surface Facilities												
Power Supply			500	500								
Mine Dry			150									
Workshop & Store				150								
Inventory				250	500							
Offices			80									
Ventilation etc.			50	50								
Screens & Bins			200	150								
Roads - minesite			100									
Access Road			150	150								
Siding Construction			250	500								
Mobile Equipment		50	250	150	50							
Miscellaneous			200	200	100							
Underground Equipment												
Total Face etc.				2,284								
Conveyors				500	750	750						
Replacements												1,656
	600	550	2,180	5,134	1,400	750						1,656

6.0 ECONOMIC SUMMARY OF PROJECT

	Pre 1976	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988–1994
Production – long tons x 1000				150	300	300	300	300	300	300	300	300	300	1800
Vancouver Sales Revenue														
a) Steam coal $35.00 LT x $1000				5250	10500	10500	10500	10500	10500	10500	10500	10500	10500	63000
b) Met coal $40.00 LT x $1000				6000	12000	12000	12000	12000	12000	12000	12000	12000	12000	72000
Total Operating Costs F.O.B.T. Vancouver x $1000				4275	8550	8550	8550	8550	8550	8550	8550	8550	8550	51300
Cash Flow x $1000														
a) Steam Coal				975	1950	1950	1950	1950	1950	1950	1950	1950	1950	11700
b) Met Coal				1725	3450	3450	3450	3450	3450	3450	3450	3450	3450	20700
Pre Production & Capital Costs x $1000	600	550	2180	5134	1400	750						1656		
Interest Charges 10%	60	121	351	450										
Outstanding Debt x $1000	660	1331	3862	9446										
Less Steam Coal Sales				8471	8345	7980	6828	5561	4167	2634	947	748		
Plus Interest				424	835	798	683	556	417	263	95	75		
Balance (Steam Coal) Cash Flow				-8895	-9180	-8778	-7511	-6117	-4584	-2897	-1042	-823	+1127	+12827
Less Met Coal Sales				7721	6057	3963	909							
Plus Interest				386	606	396	91							
Balance (Met Coal) Cash Flow				-8107	-6663	-4359	-1000	+2450	+5900	+9350	+12800	+14950	+18400	+39100

17.0 ECONOMIC ANALYSIS

17.1 No attempt has been made to determine the overall profits after tax. The application of capital cost allowances, depletion allowances, process allowances etc. would require more detailed knowledge of the project joint venture position and the assistance of financial experts. It is felt that a policy decision can be made on a progressive basis when more of the key factors affecting the project are apparent.

17.2 The project results do not appear particularly attractive at a sales price of $35.00 per ton. However it should be noted that the production capacity of the machines is calculated at 376,000 tons per annum which would add another $2,660,000 to sales revenue if realised. If the operating cost are taken at the same level this would add an additional $500,000 per annum to the cash flow or $7.5 million over the 15 year life.

17.3 If the sales revenue from the additional 76,000 tons of possible production was at $40.00 per ton this would make the gross cash flow return $52,300,000.

17.4 It should be noted the scheme presented is a basis upon which to start the overall project and that additional development would enhance the financial return.

18.0 RECOMMENDATIONS

There is sufficient evidence to warrant further exploration to establish the viability of a small mine operation. It is therefore recommended that the following procedure be adopted by Great West Steel to resolve the key factors pertinent to the proposed operation.

18.1 The executive should make a provisional policy decision to proceed with further exploration in accord with the concept herein presented. A review of these findings should be conducted in October 1976 at which time a resolution on the long term development of the project can be determined on the facts presented.

18.2 A drilling programme should be commissioned as outlined in Plan I, after discussions with Paul Dyson Consultants to ensure the best results for the expenditure allocated. If the initial results void the concept then Great West Steel should assess their position to either proceed more wide ranging exploration or pull out of the project. If the potential of this area is negated as a basis of development and expansion, it must seriously be questioned if the licences are sufficiently attractive to warrant further exploration expenditure.

18.3 Discussions should be held with Nichimen Co. Ltd. to determine the extent of their interest and their possible participation in the project.

18.4 As part of the arrangement in 18.3, Nichimen should be engaged to conduct a marketing survey to determine the demand and sales price of the coal. Nichimen would conduct negotiations with Houilleres du Basin du Nord et du Pas-de-Calais for the supply of this coal and the possibility of pre-payments on the supply as a means of financing the project. They would also determine the requirements of the Japanese Steel Mills for the utilisation of this coal in a blend.

18.5 Engage the services of Nichimen Resources Ltd. through the Roberts Consulting Corporation to clear the outcrop, drive an adit into the seam to determine the mining conditions and to obtain a bulk sample. Overall project management would be provided and reports prepared to keep Great West Steel fully informed on progress.

APPENDIX B

AN EVALUATION OF THE PINE PASS COAL PROPERTY

RESCON DEVELOPMENTS CO. LTD.

January 1976

AN EVALUATION OF THE PINE PASS COAL PROPERTY

Prepared for:

Mr. B. A. Ellis, President,

Associated Engineering Services Ltd.

December, 1975

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I. INTRODUCTION

As you requested, I have read the Paul Dyson - Birtley reports on the Pine Pass Coal property. I have not had anyone examine the lithological or electro-logs or the basic geological interpretations. Thus my comments are based solely on the data as presented. Many of these comments are re-statements of the views expressed by Mr. Dyson and Birtley, but are included to provide a continuity of approach.

II. VALUE OF A PROPERTY

The value of a coal property is dictated by the following factors:

a. The quantity of economically recoverable saleable reserves.

b. The capital and operating costs associated with the mining and processing methods by which these reserves are recoverable.

c. The quality of the product.

Naturally, these factors are inter-related. For example, the quality of the product determines the selling price which can be realized. In turn, this dictates the costs which can be borne by the operation and these costs establish the quantity of economically recoverable reserves within the property.

Over and above these other considerations, the value of a property, at any point in time, is greatly influenced by the reliability of the available data.

III. PINE PASS COAL PROPERTY

In the interests of a logical approach to this quick assessment of the Pine Pass property, we have considered the above factors in reverse order:

A. COAL QUALITY

The available data regarding the quality of the coals contained within the property is based on widely separated drill-holes.

The problems associated with this low density of information are further compounded by:

a. Poor Core Recovery

Poor core recoveries are mentioned in the report - as low as 25 percent. Obviously, such low recoveries have a very adverse effect on the reliability of the quality data, and,

b. Selective Sampling

The report indicates that, in some instances, mudstone partings were excluded from the sample sent to the laboratory. For example, in hole 75-8, the intersection 663' to 677', excluded a 1.5' mudstone parting.

In addition to the above problems, there was a considerable discrepancy between the coal quality results indicated by the 1973 drilling program and those obtained from the 1975 drilling.

For the reasons outlined above, the reliability of the available coal quality data must be somewhat suspect. Despite these reservations as to reliability, we have examined the available data and would make the following comments:

1. Washabilities

Due to the small quantities of sample available, the reliability of the washability data must be questionable (particularly since the low core recovery probably resulted in non-representative samples). As noted by Birtley, bulk samples would be required to obtain meaningful washability results.

2. Ash Contents

The indicated ash contents of some of the coal intersections are very low. To some extent this is characteristic of the area. However, we very much doubt that ROM coal ash contents of 2.4 percent (Hole 75-4, 900' to 907', Hole 75-9, 322' to 337') would, in practice, be obtained.

Similar low ash contents were derived from the drilling of the Sukunka River property. Figure 73/6 of the Dyson report shows an average air-dry raw coal ash of 35 Sukunka River (Chamberlain

Seam) samples of 5.58 percent. Actual experience indicates a significantly higher coal ash content.

3. Coal Rank and Caking Properties

With one exception (Hole 75-8, 432' to 438'), the 1975 coal intersections indicate dmmf volatile contents of below 22 percent. These volatile contents range down to 14.30 percent (Hole 75-3, 551' to 558') and 15.30 percent (Hole 75-9, 322' to 337'), i.e. only marginally out of the ASTM semi-anthracite range. Thus, with the one exception, all these coals would, according to ASTM, be classified as low-volatile bituminous. It should be noted, however, that the calculated dmmf volatile are only approximations since no sulphur contents were reported (we assumed an average 0.64 percent sulphur in our calculations). Also in some cases, where ash contents were very high, the Parr correction for mineral-matter-free basis may not be reliable.

The noted exception (Hole 75-8, 432' to 438') indicates a dmmf volatile content of 32.02 percent. Even allowing for some error in the dmmf calculation due to the high (21.1 percent) ash content of the sample, this volatile content appears anomalous - and may be an error.

Except for Hole 75-4, 900' to 907', which shows a good FSI (and a lower Ro value) the 1975 intersections exhibit poor caking properties. Although these coals are in the same general stratigraphic section of the Gething, they are very different from the Skeeter and Chamberlain Seams of the Sukunka property. The Chamberlain Seam has dmmf volatile contents in the 20 to 25 percent range, with most being above 22 percent, i.e. it is generally a medium-volatile coal. It's Ro values range between 1.33 and 1.37 percent and it has good FSI values - around 7. Giesler fluidities are excellent for this type of coal, ranging from 65 to over 400.

The Pine Pass coal intersections obtained from the 1973 drilling were generally lower rank than the 1975 coals, with dmmf volatile contents of 21.15 to 25.20. Of the seven intersections, four were in the ASTM medium volatile bituminous coal classification and the other three were just within the low-volatile range. These coals had FSI's ranging from 4-1/2 to 8.

Thus, the 1973 coals are either different seams to those encountered in 1975 or there are trends towards higher rank within the areas tested.

In any event, based on the limited available data, it seems fair to assume that - except for the small area tested in 1973 and for the Hole 75-4, 900' to 907' interesection - the coals

present on the property have very low caking properties and, probably, very low fluidities. As such they are not prime metallurgical coals.

To illustrate the effect of these quality characteristics on the property's economics, we have estimated the FOBT values of a hypothetical product coal (based on Hole 75-6, 465' to 481') using FSI's of 1-1/2 and 7.

We recognize that the specifications we have used are raw coal figures, however we believe that, in practice, they would represent a good achievement even in a washed product. In assessing the FOBT values we have compared the 1-1/2 FSI coal with a blend (or improved-coal process) coal which is contracted into the Japanese market at $33.50 per long ton FOBT Vancouver. To assess the 7 FSI coal we have compared it with a standard American low-volatile coal (Itmann). We have assumed that the total moisture content of the coal would be 6 percent. Our estimates are:

i. 1-1/2 FSI product ..... $46.50 per long ton FOBT ship

ii. 7 FSI product ..... $64.50 per long ton FOBT ship

Therefore, whilst we agree that a low ash, low FSI product should be able to find markets as a blend coal, or for use in improved-

coal or formed-coke processes, the price realized would be much lower than that which could be obtained for a prime metallurgical coal. We estimate that difference to be about $18.00 per long ton FOBT ship.

Unless further testing can prove the existence of higher quality reserves, the property must be evaluated on the basis of a moderately priced product.

B. METHODS AND COSTS

The Dyson report suggests - and we would agree - that the available data indicates little possibility of significant surface - mineable coal on the property. Therefore we have to assume that the coal would be mined by underground methods. Two basic approaches are possible:

i. Hydraulic mining

or

ii. Mechanical mining

1. Hydraulic Methods

To be effective under Western Canadian economic conditions, hydraulic mining probably requires:

i. Seam pitches in excess of 7 degrees (although pumped transportation is technically possible).

ii. Seam thicknesses of 20 feet, or more.

Thinner seams can be, and have been, mined, but productivity and, hence, economics tend to deteriorate, and

iii. Strata conditions, adjacent to the coal seam, which are good enough to avoid excessive dilution during the mining operation.

We do not have sufficient information to judge the degree to which the property satisfies these requirements. Certainly the coal is pitched enough for hydraulic mining. However seam thickness in general appear to be marginal. Strata conditions are an unknown quantity. Our initial reaction - and this is purely subjective - is that the Pine Pass conditions are not ideally suited for efficient hydraulic operations.

2. Mechanical Mining

This could involve either room and pillar methods with continuous miners (or shortwall variations) or longwall methods.

a. Room and Pillar

Continuous miners, and other mobile equipment, are only effective on gradients of up to around 15 degrees. Room and pillar extraction - to be productive - requires a roof which can be supported by roof bolts.

Depths of cover in excess of 1500 feet can cause difficulties.

Thus the efficiency of the system is sensitive to seam gradients, roof and floor conditions, depth of cover and, of course, to geological disturbances, i.e. faults, etc. With any degree of pitch, seam thicknesses of less than 5 or 6 feet are undesirable. Maximum desirable extraction heights are around 10 to 12 feet.

b. Longwall Methods

Using shield-supports and shearers, seam heights of between 5 and 14 feet can be accommodated - although the maximum practical working thickness tends to reduce as the seam gradient increases. The system can handle steeper seam gradients than is the case with mobile equipment (continuous miners). Advancing faces have operated, in thinner seam sections, on gradients of over 40 degrees. However, it must be noted that even with longwall, efficiency drops off rapidly as the seam gradients increase. Steeper seam gradients also cause difficulty with longwall panel development.

The system can handle weaker roof conditions than can be accommodated with room and pillar. However, efficiency will decrease if poor roof conditions are encountered.

In summary, the longwall system can be employed under conditions of steeper seam gradients, deeper cover and weaker roof than is the case with room and pillar methods. It is, however, an inherently inflexible system and it is very adversely affected by localized faulting, seam thinning, etc.

3. Costs

With the available data, it is impossible to realistically estimate the likely costs which would be associated with an underground mining operation at the Pine Pass property. However, based on recent studies of nearby properties, we have made some "guesstimates" of possible cost ranges - subject to the following conditional assumptions:

i. Sufficient reserves of economically mineable coal can be delineated. These reserves should be capable of sustaining a one million tons per year operation for 15 years. Assuming a 50 percent mining recovery and an 85 percent washing yield, this would require proven in-place reserves of about 35 million tons.

ii. The above reserves would be in areas which permit an effective working seam gradient of 15 degrees or less.

iii. Roof and floor conditions would be reasonably good.

iv. Excessive faulting would not be encountered.

v. Personnel would be accommodated in Chetwynd, and

vi. The plant would be located within ten miles of the railway. It has been assumed that the product would be trucked to the rail head.

Subject to the above conditions, we estimate the following cost ranges:

a. Operating Costs

$34 to $38 per long ton FOBT ship.

b. Capital Costs

$50 to $60 million.

C. COAL RESERVES

The exploration program has eliminated about 30 percent of the original land holdings as having little, or no, economic potential. This work has indicated that economic reserve potential - if it exists - is likely to be in the Johnsen Creek-Hasler Creek area. Mr. Dyson suggests that over 200 million tons of "low ash raw coal" may exist within this area.

In terms of in-place reserves, we see no particular reason why this estimate should not be valid. However, as Mr. Dyson states, "The mineability of these reserves is an unknown factor". Mr. Dyson also says that "limited outcrop information does suggest that a large portion of the prospective area may well have structural dips below 30 degrees".

Based on a quick appraisal of Mr. Dyson's structural cross-sections and the recorded surface dips (figure 75/4) we would be less certain of the extent of areas having dips of less than 30 degrees. We would be even less certain of the existence of significant areas having dips of 15 to 20 degrees, or less.

The seams of interest within the area appear to be in the 8 to 12 foot range of thickness. As noted in our comments regarding mining methods, these seam thicknesses are rather thin for effective hydraulic mining. Thus it would appear that mechanical mining methods would have to be applied. In practical terms, this implies a requirement for effective seam gradients which are preferably less than 15 degrees.

Underground mining is expensive and difficult even under reasonable conditions. In our opinion, the added difficulties of underground mining under difficult conditions - and this includes mechanical mining on pitches over 15 degrees - may well result in uneconomic operations.

The delineation of 35 million tons of in-place reserves requires an area - assuming an 8 foot thick seam - of about 4.4 square miles. This area should be relatively free from faulting, have moderate seam gradients (15 degrees or less) and reasonably good roof and floor conditions and should not be under excessive cover. Judging from the limited available data, it may be difficult to accumulate such an area within the Pine Pass property.

The limited data availability must be stressed. It may be that future work would provide more encouragement - both in terms of structure and coal quality. Our experience, however, is that mountain coal properties in Western Canada tend to evidence increased complexity as the density of data increases. The evidence to date - faults encountered in the drill-holes and photo-geologic indications of localized folding - suggests that this may well be the case with the Pine Pass property.

IV. SUMMARY

In summary, the limited data avilable in the Paul Dyson and Birtley reports suggests that the Pine Pass coal property has the following characteristics:

1. Location

The property is well-located within ten miles of the British Columbia Railway and 20 to 25 miles of Chetwynd (over paved highway). The rail distance to Vancouver or Prince Rupert is approximately 650 miles.

2. Structural

Much of the property appears to have rather steeply dipping structures. There is considerable evidence of folding and faulting. Areas of moderate pitch, suitable for mechanical mining, appear to be quite limited.

3. Coal Reserves

The principal coal reserves appear to exist in the upper 300 feet, or so, of the Gething formation. These reserves are in seams which are generally 8 to 12 feet in thickness.

4. Coal Quality

Although there are significant differences between the coal

quality indicated by the 1973 drilling and that obtained from the 1975 drilling, the coal appears to be a high-rank, generally low ash, weak-caking coal.

Free-swelling indices indicated by the 1975 drilling - with one notable exception - are 2 or less. Thus the coal does not appear to be a prime metallurgical coal, despite its apparently good volatile, ash and sulphur contents.

As a consequence we do not believe that this coal would command a metallurgical grade selling price. We estimate that the FOBT ship selling price (in 1975 dollars) would approximate $46.50 per long ton.

5. Cost Ranges

Based on a number of assumptions, we estimate that the costs which would be incurred by a one million tons per year operation on this property would be:

Operating ..... $34 to $38 per long ton FOBT ship

Capital ..... $50 to $60 million

Note: These cost estimates are based on the assumption that the property contains 35 million tons of coal in areas of moderate pitch and reasonably good mining conditions. These reserves have not been delineated and the limited available data suggests that it may be difficult to find such reserves.

V. CONCLUSION

Based on the means of our cost "guesstimates", the economics of the property - if sufficient recoverable reserves can be proven - would be roughly as follows:

Selling price per long ton FOBT ship	$46.50
Less:	
Operating Costs	$36.00
Amortization of initial capital per long ton of coal sold:	
$55 million over 15 years at 10%	$ 7.23
Equipment replacements per long ton of coal sold	$ 1.00
"Profit" per long ton of coal sold, before taxes"	$2.27

The operating costs used in the above evaluation assume reasonably good mining conditions and the capital cost estimates are modest. We would guess that there would be a greater probability of costs higher than the above "guesstimates" than there would be of lower costs. Thus we would consider the indicated "profit" margin to be totally unacceptable.

Therefore, it would appear that, based on the available information, even if sufficient recoverable reserves could be proven, the property

would have marginal economics as an underground producer. This is largely due to the indicated non-metallurgical quality of the coal. If, the coal could be considered as a metallurgical coal, the selling price and the projected economics would be radically improved.

In summary, the presently available information suggests that the property is not a good candidate for major additional exploration expenditures by Great West Steel. We also believe that a sale of the property to any group which is knowledgeable in the field of metallurgical coal will be difficult. It may be possible to interest a group to spend some further exploration funds on the property - but the terms would, in our opinion, have to be very attractive.

Since the key to any future economic potential lies in an improvement in expected coal quality, this aspect should receive priority in any future program. This implies the need for a representative bulk sample(s) and carbonisation tests to determine the coal's suitability for use in coke over blends. We again emphasize our belief that unless the coal can command a premium, metallurgical grade selling price, it is unlikely that the property could sustain an economically viable, underground operation.

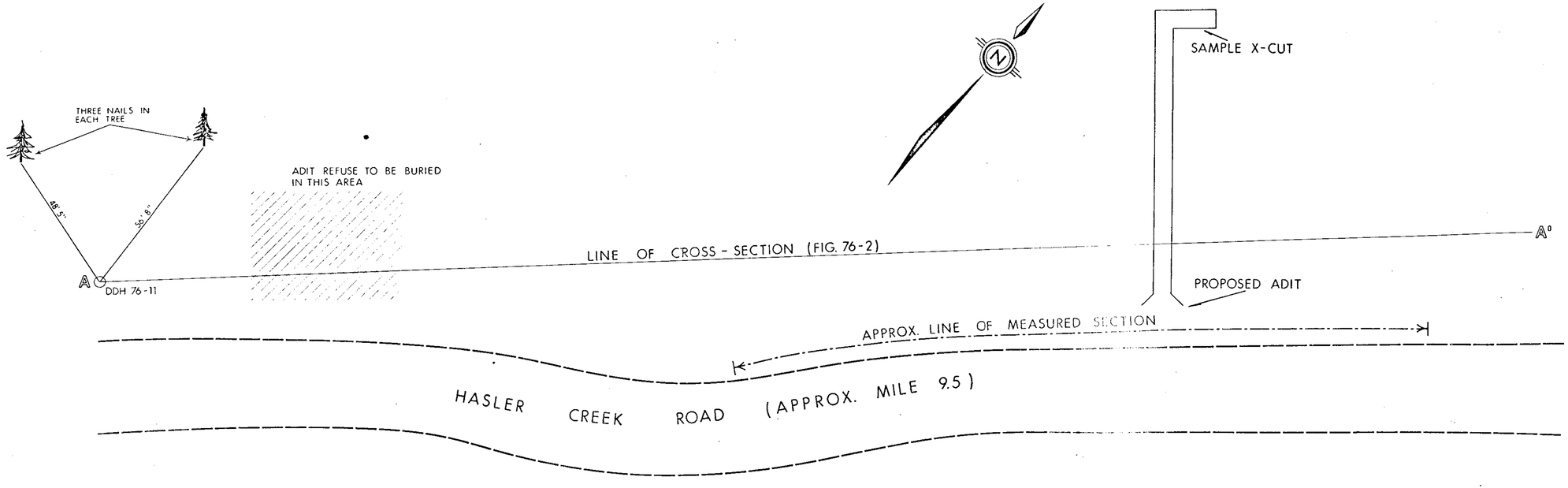


FIG. 2.

585

PR- PINE PASS 77(2)A.

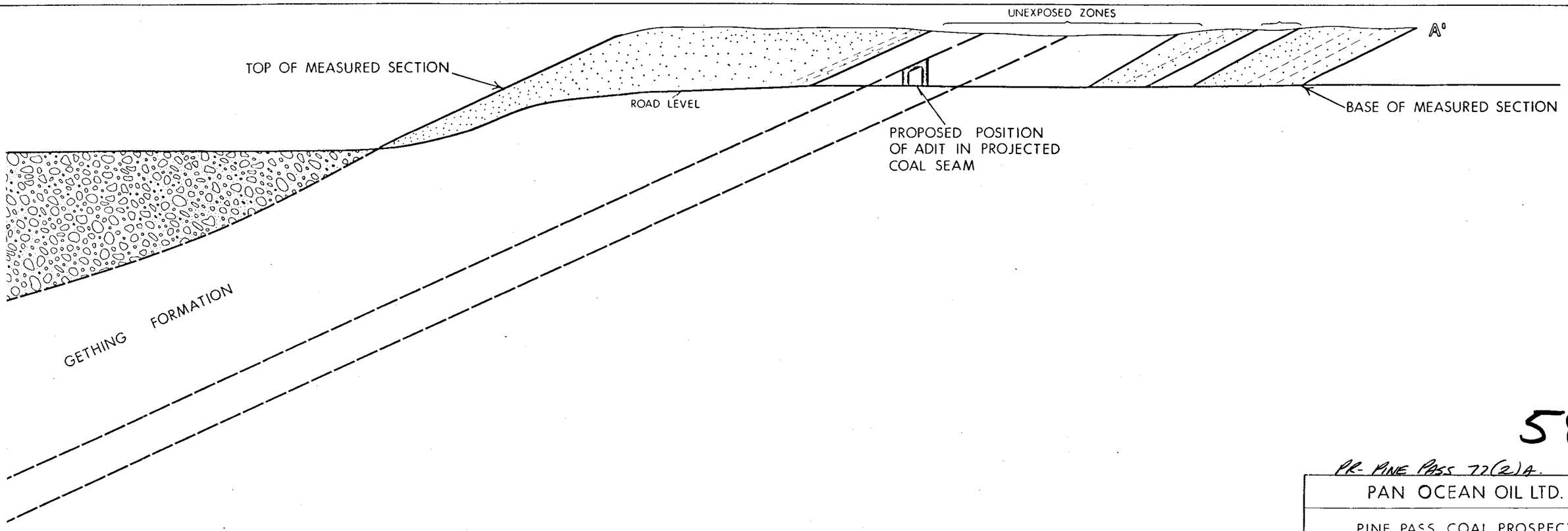
PAN OCEAN OIL LTD.

PINE PASS COAL PROSPECT
NORTH EASTERN BRITISH COLUMBIA

SKETCH MAP
PROPOSED ADIT SITE
HASLER CREEK

1" = 20' 0' 20' 40' 60' DATE: MAY/76

PAUL DYSON CONSULTANTS



585

AR-PINE PASS 72(2)A.

PAN OCEAN OIL LTD.

PINE PASS COAL PROSPECT
NORTH EASTERN BRITISH COLUMBIA

CROSS – SECTION
PROPOSED ADIT SITE
HASLER CREEK

1" = 20' 0' 10' 20' 40' 60' DATE: MAY/76

PAUL DYSON CONSULTANTS

FIG. 3.

ROKE

GAMMA RAY NEUTRON LOG

OIL ENTERPRISES LTD. CALGARY, ALBERTA

PR - PINE PASS 77 (3) A

585

FILE NO.	
LSD	
SEC	
TWP	
RGE	
W_____M	

COMPANY PAN OCEAN OIL LIMITED

WELL 76 - 11

LOCATION HASLER CREEK

FIELD PINE PASS

PROVINCE BRITISH COLUMBIA

Other Services: DENS

Permanent Datum GROUND LEVEL Elev. K.B.

Log Measured from GROUND LEVEL Ft. Above Perm. Datum CSG

Well Depths Measured from GROUND LEVEL G.L.

Run. No.	ONE										
Date	9 MAY 1976										
First Reading	160										
Last Reading	0										
Footage Logged	160										
Depth Reached	162										
Depth Driller	170										
Casing Roke											
Casing Driller	68										
Fluid Type	GEL										
Liquid Level	21										
Min. Diam.	N.Q.										
Rm @ °F											
Operating Time	1/2 HOUR										
Truck No.	34										
Recorded By	SUNDGAARD	Witnessed By	GERMSCHEID								

EQUIPMENT DATA

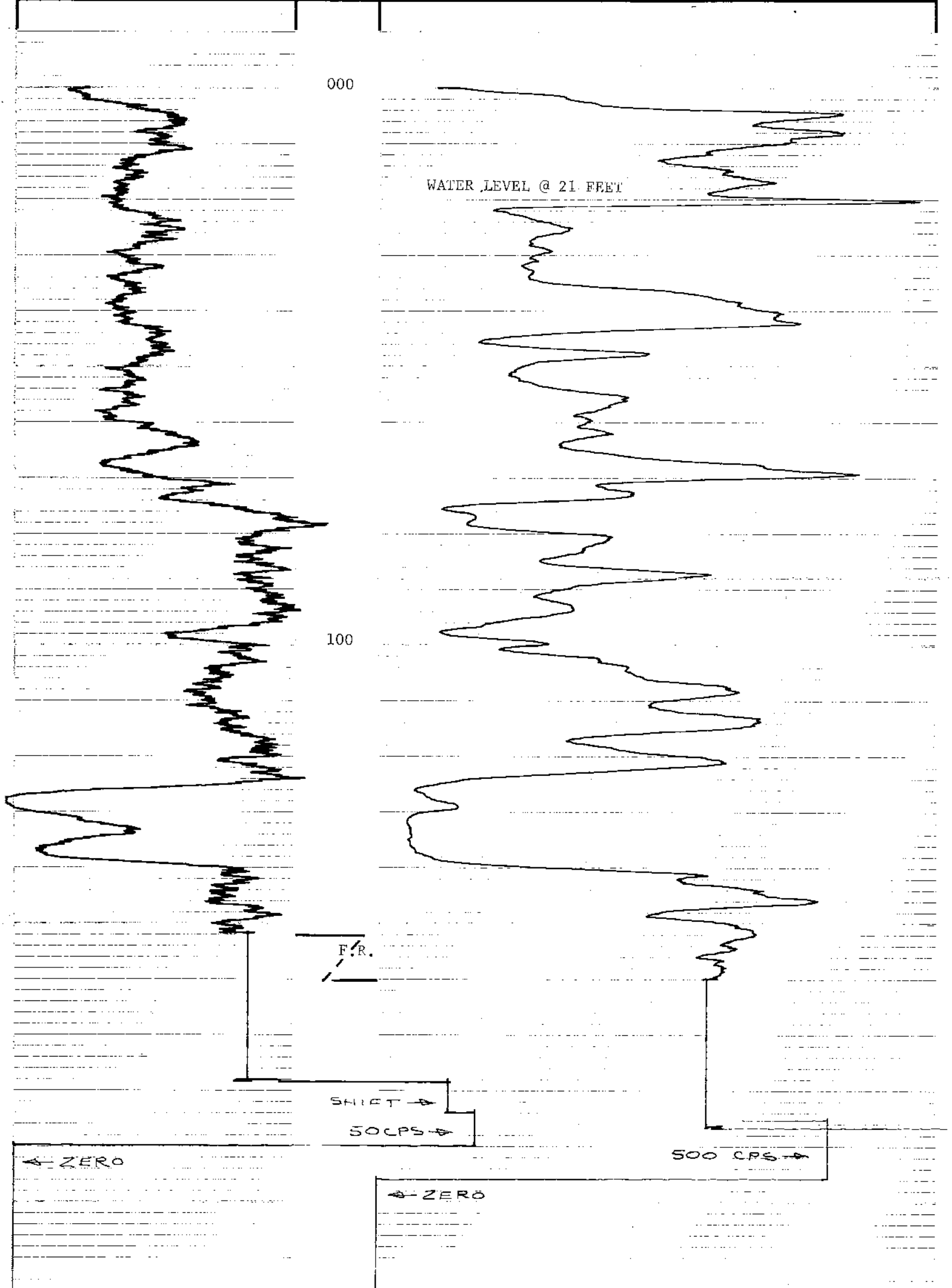
GAMMA RAY		NEUTRON	
RUN NO.	ONE	RUN NO.	ONE
TOOL MODEL NO.		LOG TYPE	NEUTRON/NEUTRON
DIAMETER	1 11/16	TOOL MODEL NO.	
DETECTOR MODEL NO.		DIAMETER	1 11/16
TYPE	GEIGER	DETECTOR MODEL NO.	
LENGTH	18 INCH	TYPE	PROPORTIONAL
DISTANCE TO N. SOURCE	8.55 FT.	LENGTH	6 INCH
		SOURCE MODEL NO.	MRC-N-SS-W
GENERAL		SERIAL NO.	606
HOIST TRUCK NO.	34	SPACING	17 INCH
INSTRUMENT TRUCK NO.	34	TYPE	AmBe
TOOL SERIAL NO.	74	STRENGTH	3 CURIES

LOGGING DATA

GENERAL				GAMMA RAY				NEUTRON			
RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN	T.C. SEC.	SENS SETTINGS	ZERO DIV. L OR R	API G. R. UNITS PER LOG DIV.	T. C. SEC.	SENS SETTINGS	ZERO DIV. L OR R	API N. UNITS PER LOG DIV.
1	0	160	12	4	100	1 L	10	3	500	0	90

REMARKS LOGGED THROUGH N.Q. DRILL ROD. ANGLE HOLE 65°

GAMMA RAY	DEPTHS	NEUTRON
GAMMA RAY INCREASES →		NEUTRON INCREASES →
API 10		API 90
10 — 110		0 — 900 — 1800



ROKE

SIDEWALL DENSILOG

OIL ENTERPRISES LTD. CALGARY, ALBERTA

PR- PINE PASS 77(3)A

585

FILE NO.
LSD
SEC
TWP
RGE
W M

COMPANY PAN OCEAN OIL LIMITED

WELL 76 - 11

LOCATION HASLER CREEK

FIELD PINE PASS

PROVINCE BRITISH COLUMBIA

Other Services: GRN

Permanent Datum GROUND LEVEL Elev. K.B.

Log Measured from GROUND LEVEL Ft. Above Perm. Datum CSG

Well Depths Measured from GROUND LEVEL G.L.

Run. No.	ONE	-	
Date	9 MAY 1976		
First Reading	160		
Last Reading	0		
Footage Logged	160		
Depth Reached	163		
Depth Driller	170		
Casing Roke			
Casing Driller	68		
Fluid Type	GEL		
Liquid Level	21		
Min. Diam.	N.Q.		
Operating Time	1/2 HOUR		
Truck No.	34		

Recorded By SUNDGAARD Witnessed By GERMSCHEID

SIDEWALL DENSILOG: T.C. SEC. 3; SENS SETTINGS 500; ZERO DIV'S. OR R 1.12 R; CPS/ DIV 13.95

GAMMA RAY: T.C. SEC.; SENS SETTINGS REPEAT SECTION (25" - 100'); ZERO DIV'S. OR R; API G.R. UNITS PER LOG DIV. EXPANDED SCALE

GENERAL: RUN NO. 1; DEPTHS FROM 0, TO 160; SPEED FT/MIN 12, 145; SEC. 5

ANGLE HOLE 65°

REMARKS: LOGGED THROUGH N.Q. DRILL ROD

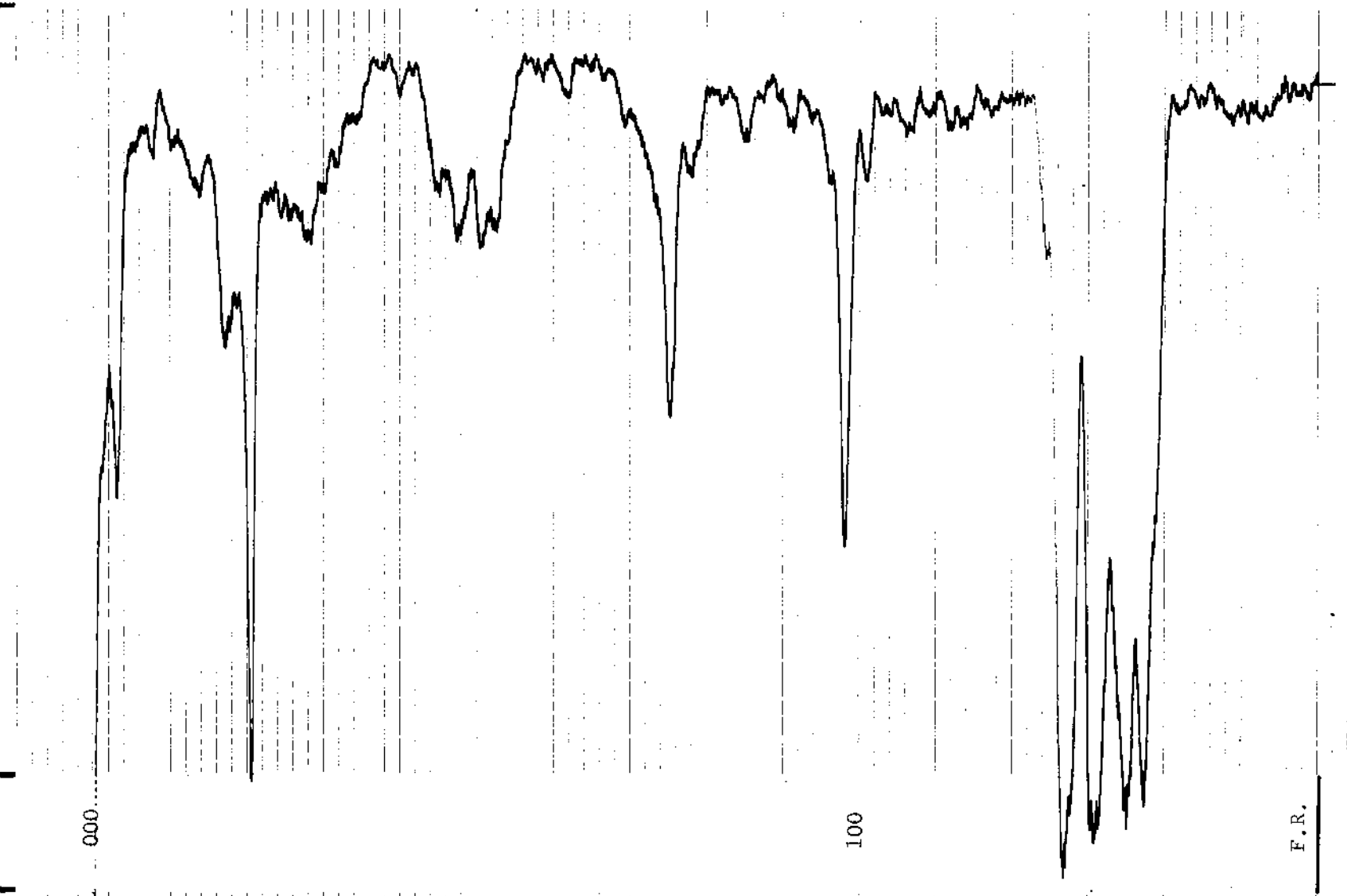
CALIPER (DIAMETER - INCHES)

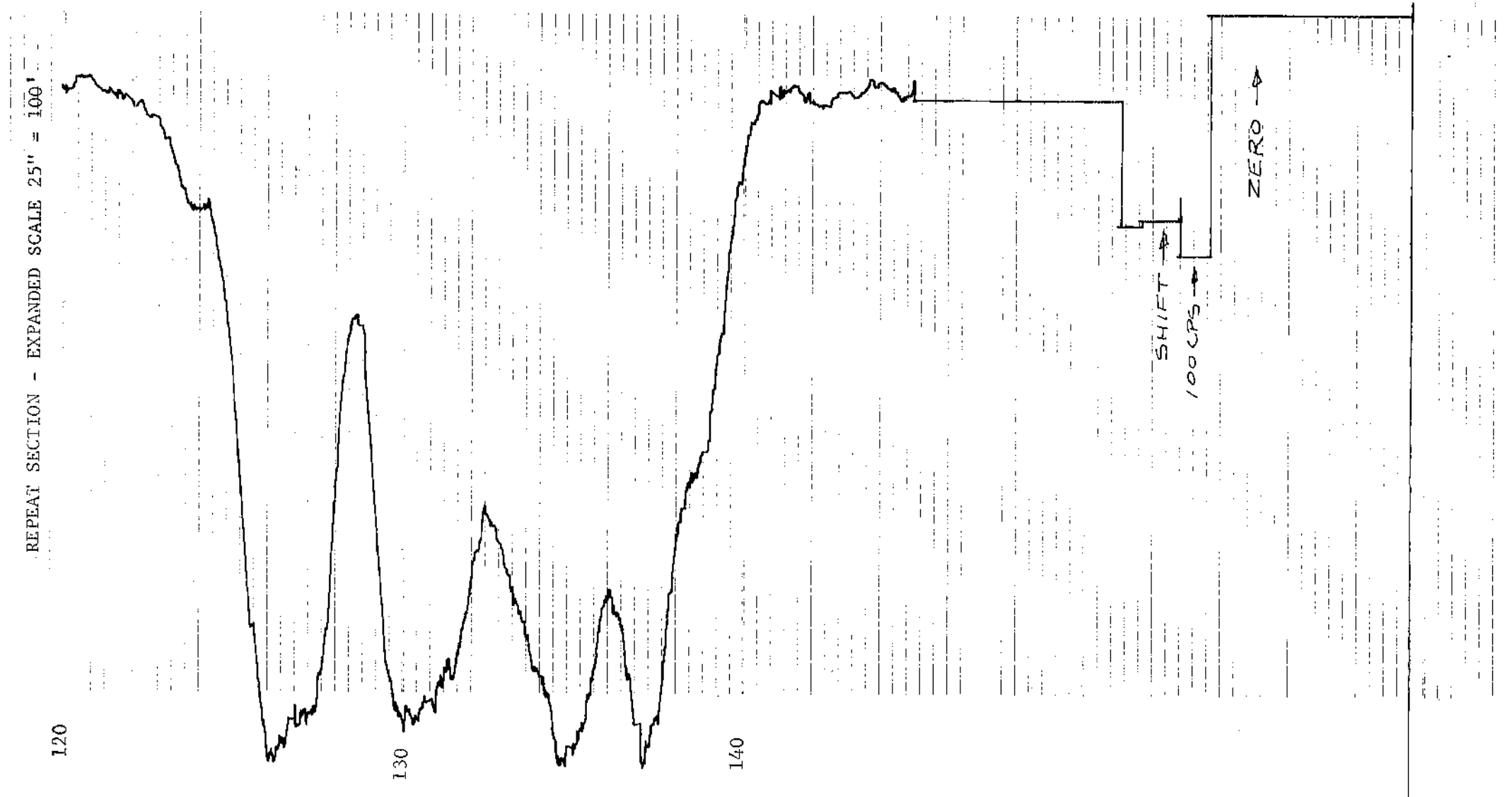
DEPTHS

GAMMA RAY API

BULK DENSITY (GRAMS/CC)

2.80 2.70 2.60 2.50 2.40 2.30 2.20 2.10 2.00 1.90 1.80 1.70 1.60 1.50 1.40 1.30 1.20 1.10 1.00





ROKE

GAMMA RAY
SIDEWALL DENSILOG
CALIPER

OIL ENTERPRISES LTD. CALGARY, ALBERTA

RE- PINE PASS 77(8)4.

585

FILE NO.
LSD
SEC
TWP
RGE
W M

COMPANY PAN OCEAN OIL LIMITED

WELL 77 - 1

LOCATION HASLER CREEK

FIELD PINE PASS

PROVINCE BRITISH COLUMBIA

Other Services:
GRN

Permanent Datum GROUND LEVEL Elev.
Log Measured from GROUND LEVEL Ft. Above Perm. Datum
Well Depths Measured from GROUND LEVEL

K.B.
CSG
G.L.

Run. No.	ONE		
Date	13 FEB 1977		
First Reading	459 70		
Last Reading	305 0		
Footage Logged	224		
Depth Reached	462		
Depth Driller	470		
Casing Roke	16		
Casing Driller			
Fluid Type	WATER		
Liquid Level	91		
Min. Diam.	5 1/8"		
Operating Time	1 HOUR		
Truck No.	104		

Recorded By GIBEAU Witnessed By DYSON

GENERAL: RUN NO. | DEPTHS FROM | DEPTHS TO | SPEED FT/MIN

RUN NO.	FROM	TO	SPEED FT/MIN
1	0	70	12
	305	459	12

GAMMA RAY: T.C. SEC. | SENS SETTINGS | ZERO DIV/L OR R | API G.R. UNITS PER LOG DIV.

SIDEWALL DENSILOG: T.C. SEC. | SENS SETTINGS | ZERO DIV/L OR R | CPS/DIV

	T.C. SEC.	SENS SETTINGS	ZERO DIV/L OR R	CPS/DIV
	3	500	1.4R	39.28
	3	500	1.4R	39.28

REMARKS: DENSITY TOOL # 554

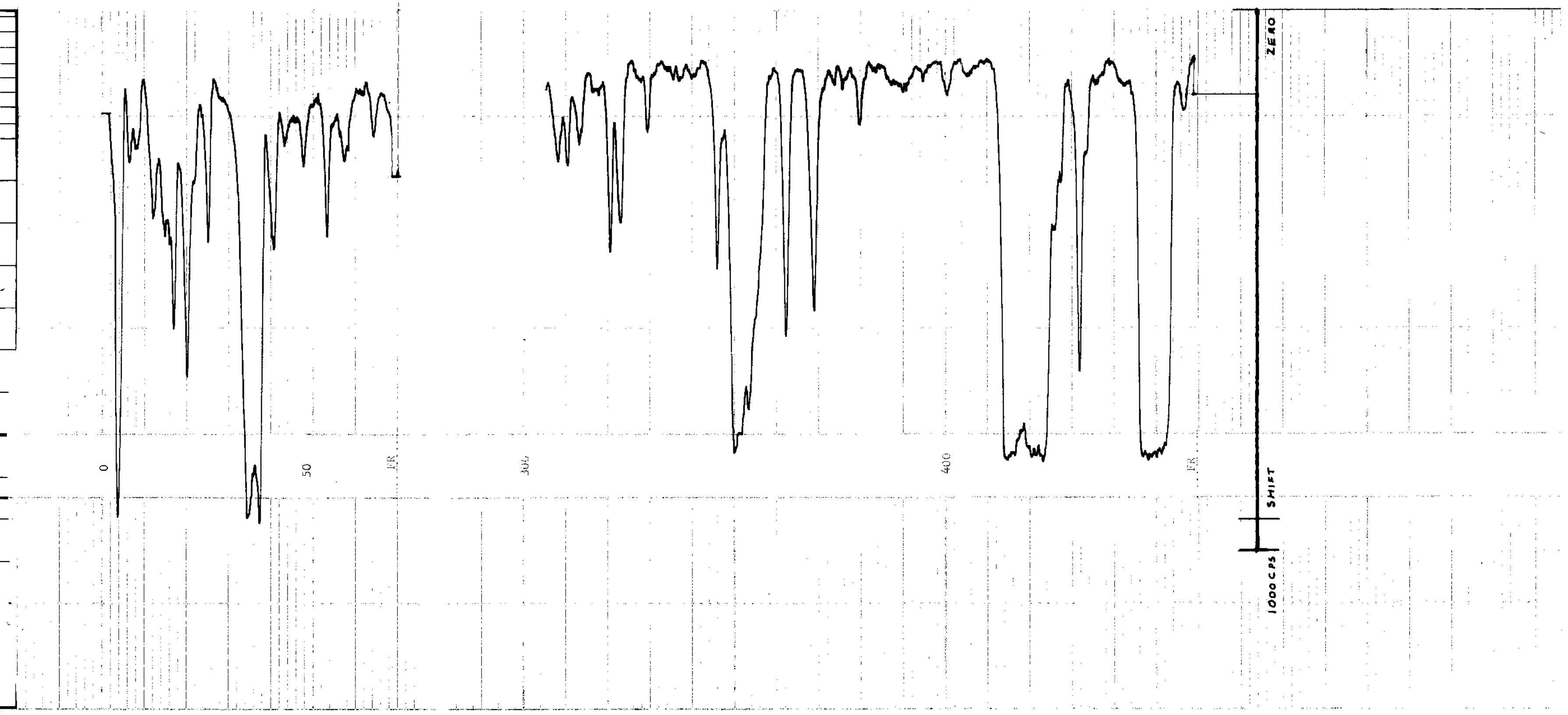
CALIPER (DIAMETER – INCHES)

DEPTHS

GAMMA RAY API

BULK DENSITY (GRAMS/CC)

2.80 2.70 2.60 2.50 2.40 2.30 2.20 2.10 2.00 1.90 1.80 1.70 1.60 1.50 1.40 1.30 1.20 1.10 1.00



ROKE OIL ENTERPRISES LTD. CALGARY, ALBERTA

GAMMA RAY NEUTRON LOG
CALIPER
DENSILOG

FILE NO. PC- PINE PASS 77(8)A

585

LSD	
SEC	
TWP	
RGE	
W __ M	
COMPANY	PAN OCEAN OIL LIMITED
WELL	77 - 1
LOCATION	HASLER CREEK
FIELD	PINE PASS
PROVINCE	BRITISH COLUMBIA
Permanent Datum	GROUND LEVEL Elev.
Log Measured from	GROUND LEVEL Ft. Above Perm. Datum
Well Depths Measured from	GROUND LEVEL
Other Services:	DENS
K.B.	
CSG	
G.L.	

Run. No.	ONE
Date	13 FEB 1977
First Reading	461
Last Reading	0
Footage Logged	461
Depth Reached	462
Depth Driller	470
Casing Roke	16
Casing Driller	
Fluid Type	WATER
Liquid Level	91
Min. Diam.	5 1/8"
Rm @ °F	
Operating Time	2 HOURS
Truck No.	104
Recorded By	GIBEAU
Witnessed By	DYSON

EQUIPMENT DATA

GAMMA RAY		NEUTRON	
RUN NO.	ONE	RUN NO.	ONE
TOOL MODEL NO.		LOG TYPE	NEUTRON/NEUTRON
DIAMETER	$1\frac{11}{16}$	TOOL MODEL NO.	
DETECTOR MODEL NO.		DIAMETER	$1\frac{11}{16}$
TYPE	SCINTILLATION	DETECTOR MODEL NO.	
LENGTH	4 INCH	TYPE	PROPORTIONAL
DISTANCE TO N. SOURCE	5.5 FT.	LENGTH	6 INCH
		SOURCE MODEL NO.	MRC-N-SS-W
GENERAL		SERIAL NO.	598
HOIST TRUCK NO.	104	SPACING	17 INCH
INSTRUMENT TRUCK NO.	104	TYPE	AmBe
TOOL SERIAL NO.	155	STRENGTH	3 CURIES

LOGGING DATA

GENERAL				GAMMA RAY				NEUTRON			
RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN	T.C. SEC.	SENS SETTINGS	ZERO DIV. L OR R	API G. R. UNITS PER LOG DIV.	T. C. SEC.	SENS SETTINGS	ZERO DIV. L OR R	API N. UNITS PER LOG DIV.
1	0	91	12	5	100	0	14	3	1000	12L	240
	91	461	12	5	100	0	14	3	500	0	120

REMARKS

GAMMA RAY	DEPTHS	NEUTRON
GAMMA RAY INCREASES → API →|14|← 0 … 140		NEUTRON INCREASES → API →|240|← 2880 … 5280 … 7680

ROKE

GAMMA RAY NEUTRON LOG
CALIPER
DENSILOG

OIL ENTERPRISES LTD. CALGARY, ALBERTA

PR - PINE Pass 77 (3) A.

FILE NO. 585

LSD
SEC
TWP
RGE
W M

COMPANY PAN OCEAN OIL LIMITED

WELL 77 - 2

LOCATION HASLER CREEK

FIELD PINE PASS

PROVINCE BRITISH COLUMBIA

Other Services:
DENS

Permanent Datum GROUND LEVEL Elev.
Log Measured from GROUND LEVEL Ft. Above Perm. Datum
Well Depths Measured from GROUND LEVEL

K.B.
CSG
G.L.

Run. No.	ONE		
Date	13 FEB 1977		
First Reading	296		
Last Reading	0		
Footage Logged	296		
Depth Reached	298		
Depth Driller	300		
Casing Roke			
Casing Driller			
Fluid Type	WATER		
Liquid Level	61		
Min. Diam.	5 1/8"		
Rm @ °F			
Operating Time	1 HOUR		
Truck No.	104		

Recorded By GIBEAU Witnessed By DYSON

EQUIPMENT DATA

	GAMMA RAY	NEUTRON
RUN NO.	ONE	ONE
TOOL MODEL NO.		NEUTRON/NEUTRON
DIAMETER	1 11/16	1 11/16
DETECTOR MODEL NO.		
TYPE	SCINTILLACTION	PROPORTIONAL
LENGTH	4 INCH	6 INCH
DISTANCE TO N SOURCE	5.5 FT.	MRC-N SS-W
SOURCE MODEL NO.		
SERIAL NO.		598
SPACING		17 INCH
TYPE		AmBe
STRENGTH		3 CURIES

GENERAL

HOIST TRUCK NO.	104
INSTRUMENT TRUCK NO.	104
TOOL SERIAL NO.	155

LOGGING DATA

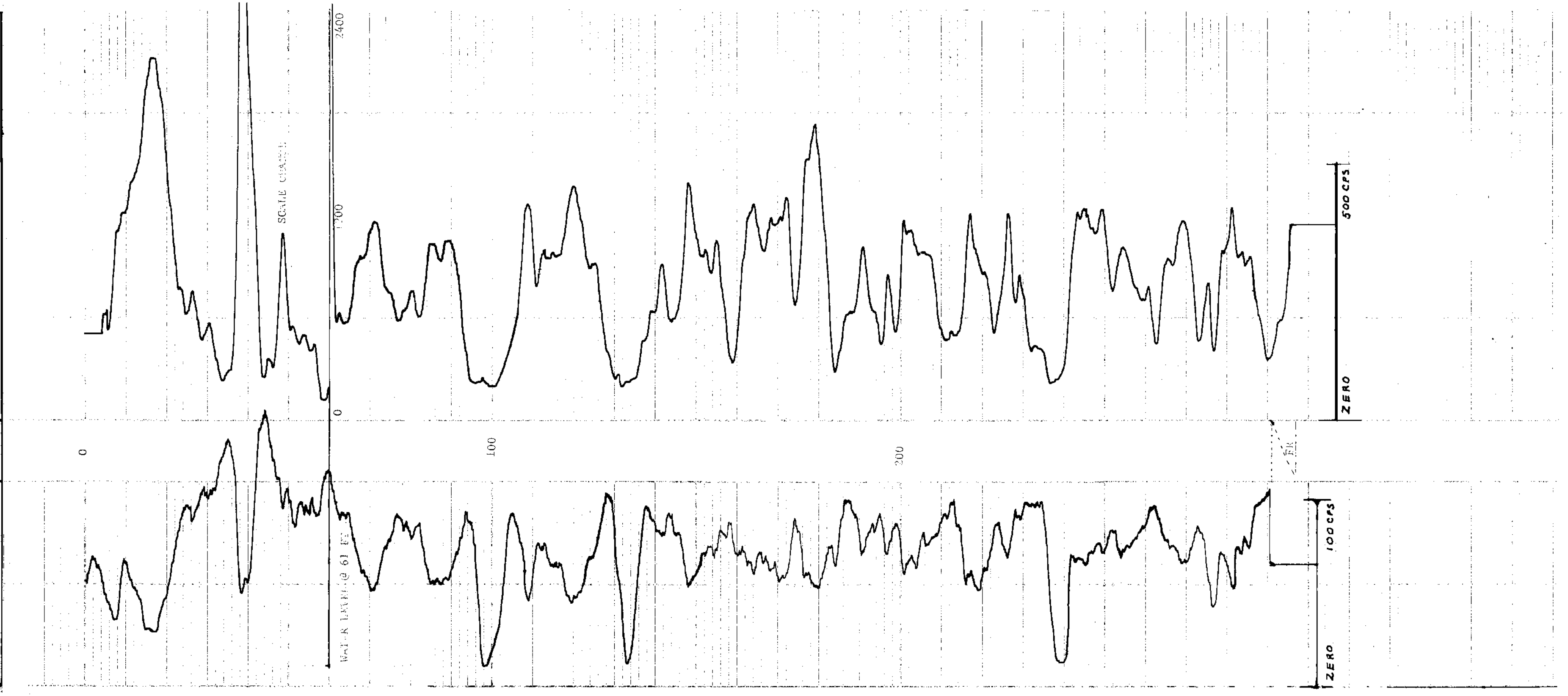
RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN	T.C. SEC.	GAMMA RAY SENS SETTINGS	GAMMA RAY ZERO DIV. L OR R	GAMMA RAY API G. R. UNITS PER LOG DIV.	NEUTRON T.C. SEC.	NEUTRON SENS SETTINGS	NEUTRON ZERO DIV. L OR R	NEUTRON API N. UNITS PER LOG DIV.
1	0	61	12	5	100	0	14	3	1000	12L	240
	61	296	12	5	100	0	14	3	500	0	120

REMARKS

DEPTHS

GAMMA RAY — GAMMA RAY INCREASES — API 14 — 0 — 140

NEUTRON — NEUTRON INCREASES — API 40 — 2880 — 5280 — 7680



ROKE

GAMMA RAY
SIDEWALL DENSILOG
CALIPER

OIL ENTERPRISES LTD. CALGARY, ALBERTA

PR- PINE PASS 77(8)A

585

FILE NO.
LSD
SEC
TWP
RGE
W M

COMPANY PAN OCEAN OIL LIMITED

WELL 77 - 2

LOCATION HASLER CREEK

FIELD FINE PASS

PROVINCE BRITISH COLUMBIA

Other Services: GRN

Permanent Datum GROUND LEVEL Elev.
Log Measured from GROUND LEVEL Ft. Above Perm. Datum
Well Depths Measured from GROUND LEVEL

K.B.
CSG
G.L.

Run. No.	ONE		
Date	13 FEB 1977		
First Reading	294		
Last Reading	0		
Footage Logged	294		
Depth Reached	298		
Depth Driller	300		
Casing Roke			
Casing Driller			
Fluid Type	WATER		
Liquid Level	61		
Min. Diam.	5 1/8"		
Operating Time	1 HOUR		
Truck No.	104		

Recorded By GIBEAU Witnessed By DYSON

RUN NO.	GENERAL DEPTHS FROM	TO	SPEED FT/MIN	GAMMA RAY T.C. SEC.	SENS SETTINGS	ZERO DIVS. OR R	API G.R. UNITS PER LOG DIV.	SIDEWALL DENSILOG T.C. SEC.	SENS SETTINGS	ZERO DIVS. OR R	CPS/ DIV
1	0	294	12					3	500	1.4R	39.28

REMARKS DENSITY TOOL # 554

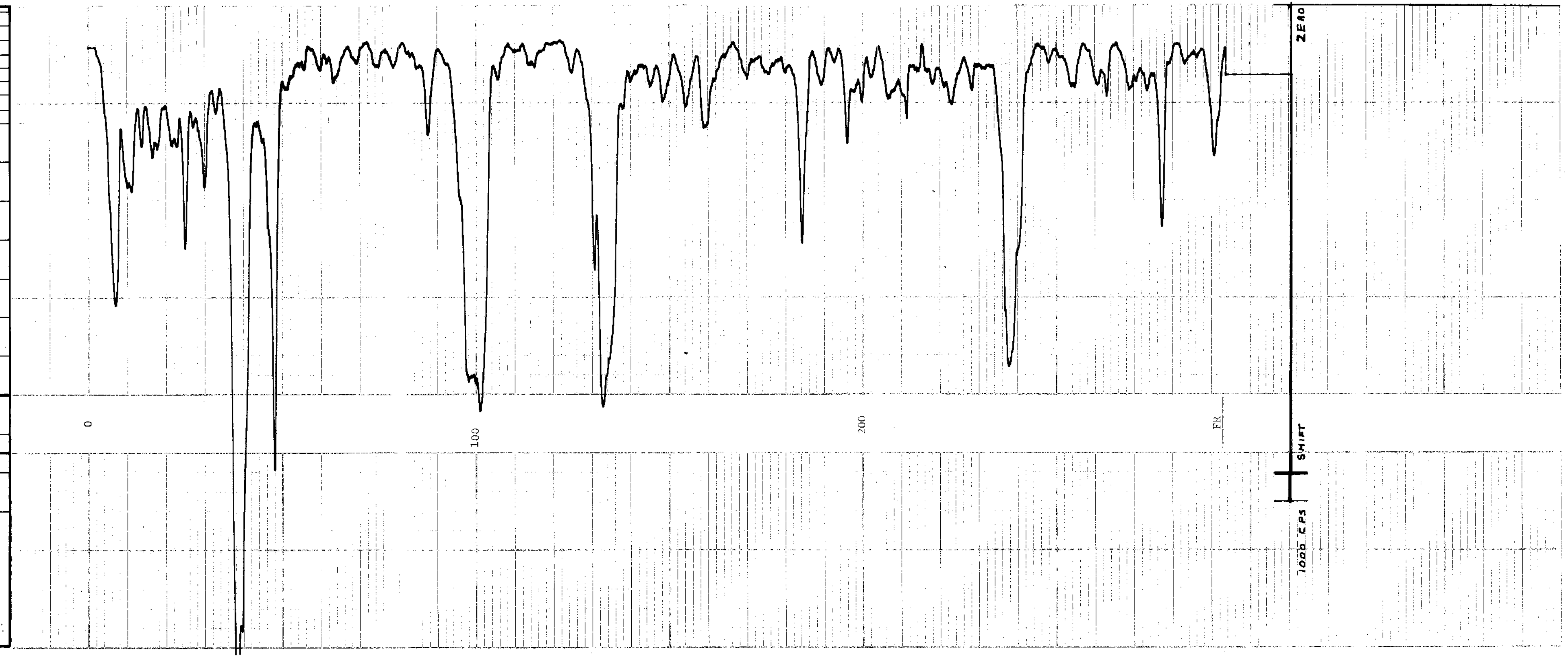
CALIPER (DIAMETER - INCHES)

DEPTHS

GAMMA RAY (API)

BULK DENSITY (GRAMS/CC)

2.80 2.70 2.60 2.50 2.40 2.30 2.20 2.10 2.00 1.90 1.80 1.70 1.60 1.50 1.40 1.30 1.20 1.10 1.00



PAUL DYSON
CONSULTANTS

STRATIGRAPHIC LOG

NR- Pine Pass 77(3)A

585

DRILL HOLE 76-11 AREA Hasler Creek

COMPANY Pan Ocean Oil Ltd.

COORDINATES 122° 00' W 55° 30' N

GROUND ELEVATION 2700' TOTAL DEPTH 170'

MECHANICAL LOGS RUN Density; Gamma Ray/Neutron

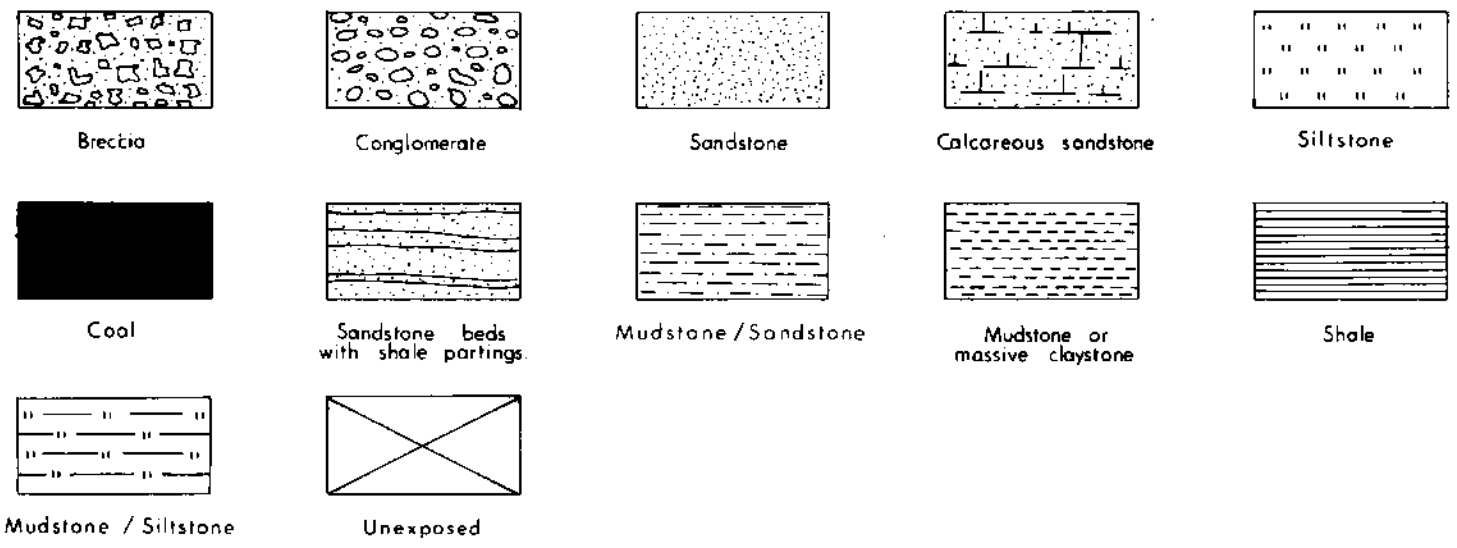
DRILLING METHOD Diamond Wireline

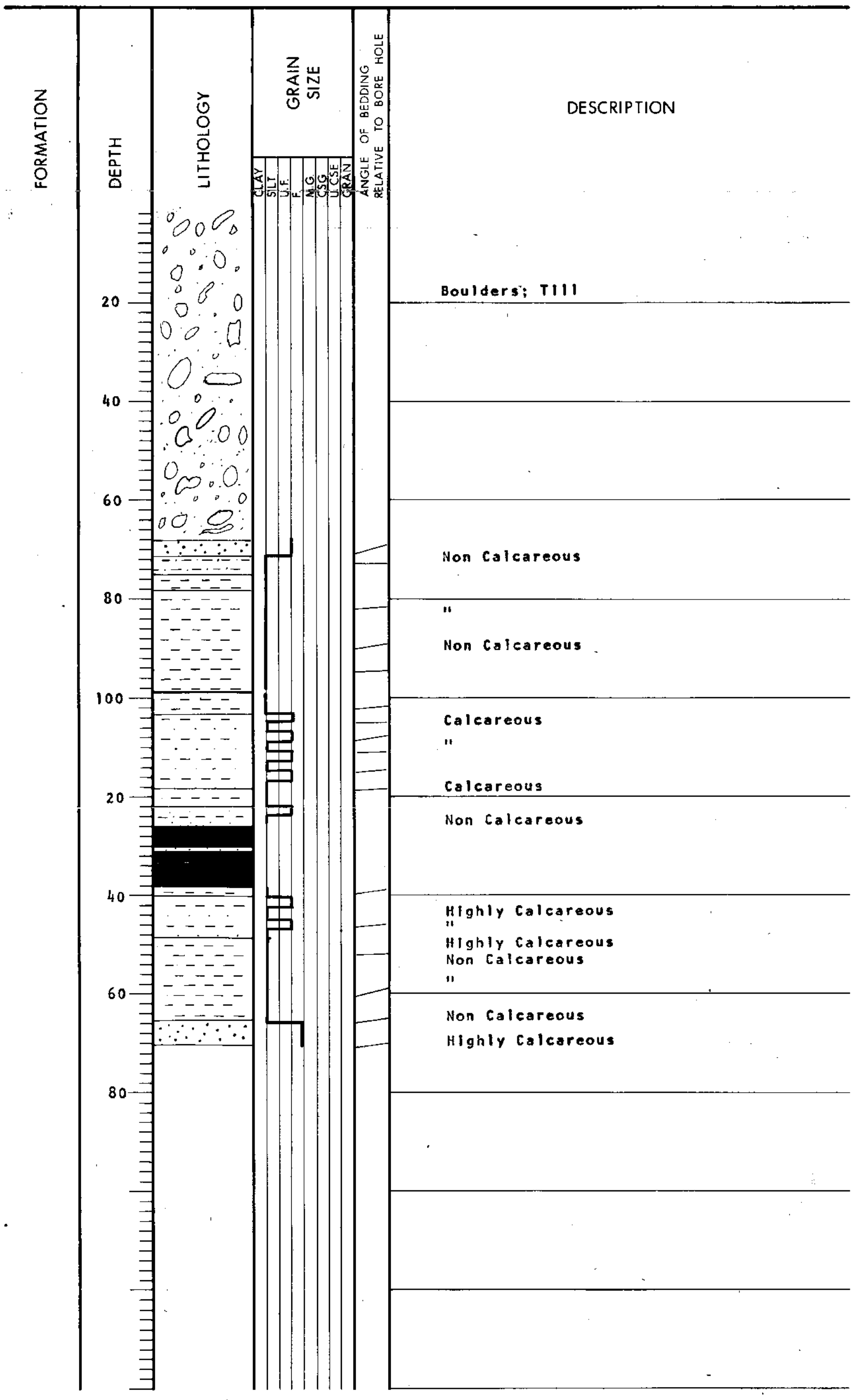
HOLE SIZE N/Q DATE OF COMPLETION May 11/76

LOGGED BY Gregory Germscheid

REMARKS Hole drilled at 65°, on azimuth of 40°.

LITHOLOGIC SYMBOLS





DESCRIPTION

Boulders; Till

Non Calcareous

"

Non Calcareous

Calcareous

"

Calcareous

Non Calcareous

Highly Calcareous

"

Highly Calcareous

Non Calcareous

"

Non Calcareous

Highly Calcareous

PAUL DYSON
CONSULTANTS

STRATIGRAPHIC LOG

PR- PINE PASS 77(3)A.

585

DRILL HOLE Measured Surface Section AREA Hasler Creek

COMPANY Pan Ocean Oil Ltd.

COORDINATES 122° 00' W 55° 30' N

GROUND ELEVATION 2700' TOTAL DEPTH 110'

MECHANICAL LOGS RUN N/A

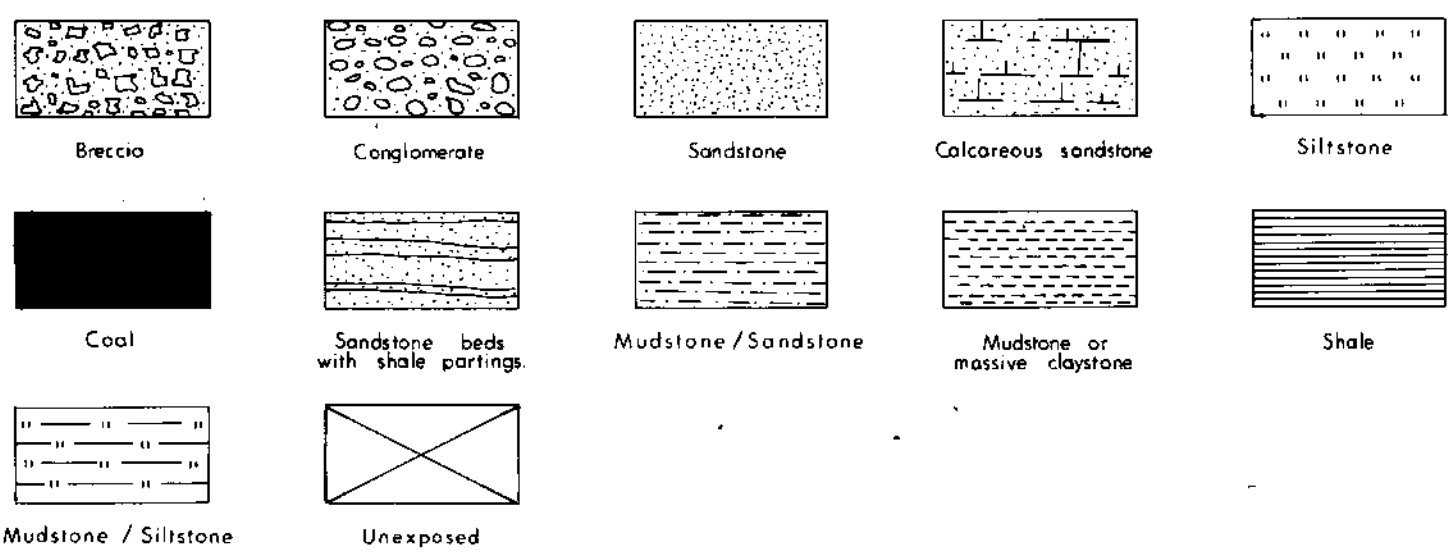
DRILLING METHOD N/A

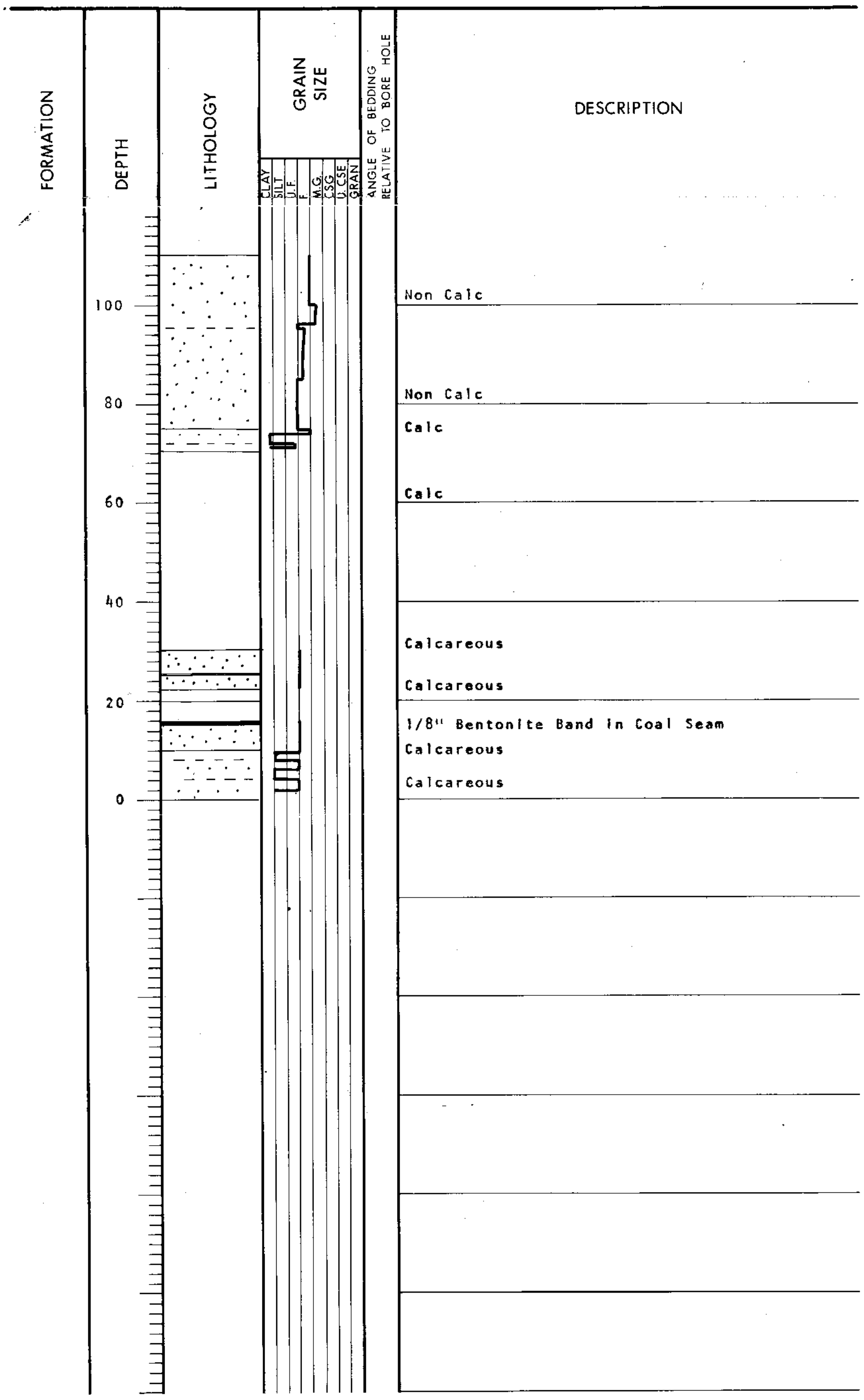
HOLE SIZE N/A DATE OF COMPLETION May 10/76

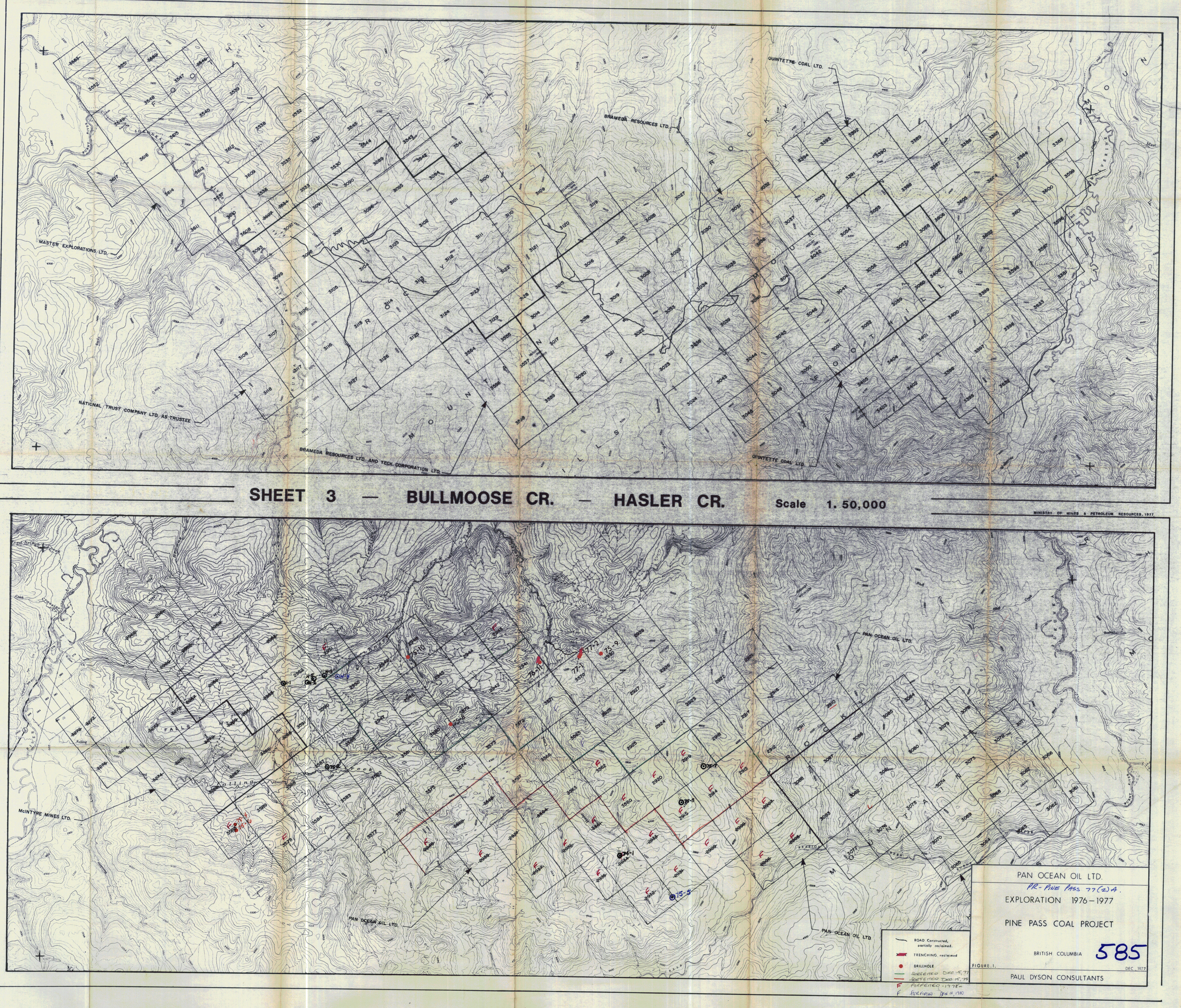
LOGGED BY Gregory Germscheid

REMARKS Logged for purpose of establishing correlation with drill hole 76-11. Section ends 200' from drill hole.

LITHOLOGIC SYMBOLS






SHEET 3 — BULLMOOSE CR. — HASLER CR.
Scale 1. 50,000
MINISTRY OF MINES & PETROLEUM RESOURCES, 1977
QUINTETTE COAL LTD.
BRAMEDA RESOURCES LTD.
MASTER EXPLORATIONS LTD.
NATIONAL TRUST COMPANY LTD. AS TRUSTEE
BRAMEDA RESOURCES LTD. AND TECK CORPORATION LTD.
McINTYRE MINES LTD.
PAN OCEAN OIL LTD.
ROAD Constructed, partially reclaimed.
TRENCHING, reclaimed
DRILLHOLE
FORFEITED DEC 15, 77
FORFEITED DEC 15, 75
F FORFEITED - 1978 -
F FORFEITED JAN 10, 1980
PAN OCEAN OIL LTD.
PR - PINE PASS 77(2)A.
EXPLORATION 1976 – 1977
PINE PASS COAL PROJECT
BRITISH COLUMBIA
585
FIGURE. 1.
DEC., 1977
PAUL DYSON CONSULTANTS