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COMPLETION REPORT

PRODUCTION WELL No: 1

for

PENINSULA DEVELOPMENT LTD.

SECHELT PENINSULA
BRITISH COLUMBIA

by

W. L. Brown, P.Eng.

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May 1972

TABLE OF CONTENTS

LIST OF FIGURES AND REPORTS

INTRODUCTION

This report summarizes work done to construct and pump test a well for Peninsula Developments Ltd. The well is located on parcel "A" D.L. 4537 Gp. 1 in the New Westminster District Plan No. 10783. This property is adjacent to the Sunshine Coast Highway 101 about 15 miles north of Sechelt near Lord Jim's Lodge.

The well was drilled into fractured dioritic bedrock. The major fracture was encountered at a depth of 210 feet. A two day pump test was run and the well has been rated at 44 Imp. gpm.

The pumped water is potable and apart from a slightly high pH, will meet the Canadian Drinking Water Standards.

GEOLOGY

Two fracture zones cut across the subject property. These fractures are shown on Figure: 1 of this report.

Production Well No. 1 (PW-1) is located on one of these zones. Lord Jim's Lodge well is located just off the other zone. The bedrock is a diorite which was moderately hard to drill.

From data on the pump test we were able to determine that the fractures are clear and open. The fracture transects the major fracture which crosses the Sunshine Coast highway to the southeast of the property. This fracture is also connected to the fractured rock beneath the large swampy area to the north of the property. The unexpected high permeabilities are responsible for the well's high productivity.

CONSTRUCTION

Drilling began on April 19 and was completed on April 21, 1972.

The overburden material was drilled using an 8-inch diameter bit. When bedrock was encountered at a depth of 27 feet, 6-1/4 inch light wall casing was set and seated tightly into the top of the rock. The rock was then drilled using a 6-1/4 inch diameter drill bit (see well log Fig: 2). Water-bearing fractures were encountered at 65, 132, 185 and 210 feet depths. When each fracture was encountered the flow of water from the hole was noted. These flows are given in Fig: 2, which shows that the major quantity of water comes from the fracture below a depth of 210 feet.

Drilling proceeded 14 feet below the last fracture. Since no new fractures were encountered, drilling was stopped at a depth of 225 feet. The well was then cleaned and swabbed for fifteen hours to remove rock cuttings and to clean out the rock fractures.

To protect the well against possible vandalism a plate has been padlocked to the top of the well casing.

TESTING

Hydraulics of Well

The completed well was continuously pump tested for 46 hours. The pumping rates were stepped in the following manner:

30 Igpm	for a period of			7 minutes
49 Igpm	"	"	"	16 minutes
58 Igpm	"	"	"	45-1/2 hours

At the end of this test the drawdown was 156 feet below ground. The pump was turned off and recovery water levels were recorded for 3 hours.

Using the data from the pump test and the subsequent well recovery the hydraulic characteristics of the well were calculated. The long term pumping characteristics of the well were evaluated using this data and our previous experience with bedrock wells on the Sechelt Peninsula. At a pumping rate of 44 Igpm the predicted water level after 100 days of continuous discharge should be 130 feet below ground. This rate would provide a 50% factor of safety against the well running dry after a long dry summer.

Inorganic Water Quality

A sample of the pumped water was taken from the well just after the pumping started and again just before the pump was turned off. These samples were submitted to a chemical laboratory for inorganic analysis.

The first sample was analysed for chloride only and the second sample was given a complete chemical analysis. Copies of the Chemist's report are attached to the back of this report. The Chemist reports that the water is alkaline, extremely soft and high in dissolved mineralization. The mineralization is primarily in the form of sodium bicarbonate. The pH at 8.9 is rather high, but we believe that with continued pumping this figure can be reduced to around 8.5 which is the maximum limit laid down in the Canadian Drinking Water Standards. The pH did drop with approximately two days of pumping from an initial figure of 9.00 to 8.90. Our chemist informs us that storing the water in a well ventilated storage tank will also help considerably to reduce this pH.

The water has a slight sulphurous (rotten egg) odour which is typical of most bedrock wells in the Sechelt area. It is our experience that this odour will decrease after the well is pumped for several weeks. Also it will disappear if the water is stored in a well ventilated tank.

WELL OPERATION AND MAINTENANCE

1. Pump

Based on available data this well is capable of producing a continuous discharge flow of 44 Imperial gallons per minute. The expected pumping level for continuous pumping at this rate for 100 days is 130 feet below present ground surface.

A submersible type pump is recommended. The bottom of the pump motor should be set at 183 feet below ground.

2. Pump Housing

The submersible well head fitting is best housed in a below ground manhole structure. This will protect the well head fittings and controls from both vandalism and freezing temperatures. The manhole cover should be located directly over the well to allow the pump to be readily set and withdrawn. A small 3 gpm capacity sump pump with automatic controls should be set at the bottom of the manhole to keep it dry. No surface water should be allowed to run into the ground in the annular space immediately outside the surface casing. To prevent this the concrete floor or pad should be laid up against this surface casing.

If a pump house is being considered it should be so designed that the pump can be withdrawn from the well. One wall should be within two feet of the well and a window or removable section of the wall

installed in this wall so that machine operators can see the well. Also a 4' x 4' removable section of the roof should be placed over the pump.

Great care and supervision will be necessary during pump house or manhole construction to ensure that no debris, cement, etc. enters the well. We emphasize this as we have had past experiences of wells being junked by innocent carelessness.

3. A program of water level and flow measurements must be started on a weekly schedule when production starts. This means that the access hole provided should be maintained free so that a 3/8-inch probe can easily pass. These records should be reviewed by us at regular intervals during the first year of production.

CONCLUSIONS

1. Based upon available data we judge that PW-1 has a safe pumping capacity of 44 Imp. gpm (53 US gpm).

2. The water quality is good and should be acceptable.

3. The pumping of the well should not seriously affect the pumping capacity of the well owned by Lord Jim's Lodge.

RECOMMENDATIONS

1. A submersible type pump should be set with the bottom of the pump motor at a depth of 183 feet below ground.

2. The well and pump fittings should be chlorinated prior to use.

3. Sufficient storage should be provided to hold the water for a minimum of 1 day prior to consumption. The storage tank or reservoir should be well ventilated.

4. The well operation and maintenance program set out in this report be closely followed.

CAN TEST LTD.

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Report On Water Samples for Chemical Analysis File No. 3003 A

Report No.

Reported to Robinson, Roberts & Brown Date May 9, 1972

1632 McGuire

North Vancouver, B.C.

We have tested two samples of water submitted by you on May 1, 1972 and report as follows:

Sample Identification

The samples were submitted in plastic bottles labelled -

Sample 1 Penninsular Developments PW1, April 25, 1972 1930 hours

Sample 2 Penninsular Developments PW1, April 27, 1972

Method of Testing

The samples were tested in accordance with the procedures set down in "Standard Methods for the Examination of Water and Waste Water" - 13th Edition, published by the American Public Health Association, 1971.

Chemical Analysis of Water Samples

Test		1	2	
pH (electrometric)		9.00	8.90	
Color (Pt-Co scale)		-	1.0	ppm
Turbidity (SiO_2 scale)		-	6.7	ppm
Suspended Matter		-	10.8	ppm
Fixed		-	9.5	ppm
Volatile		-	1.3	ppm
Hardness (Calculated)		-	2.5	ppm
Dissolved Anions				
Alkalinity				
Bicarbonates	HCO_3	-	254.	ppm
Carbonates	CO_3	-	29.	ppm
Hydroxyl Ion	OH	-	nil	ppm
Chlorides	Cl	12.0	29.0	ppm
Sulfates	SO_4	-	11.6	ppm
Phosphates	PO_4	-	0.2	ppm
Nitrates	N	-	L 0.1	ppm
Sulfides	S	-	0.2	ppm
Dissolved Cations				
Silica	SiO_2	-	13.8	ppm
Iron	Fe	-	L 0.05	ppm
Aluminum	Al	-	0.05	ppm
Calcium	Ca	-	L 0.5	ppm
Magnesium	Mg	-	0.6	ppm
Sodium	Na	-	130.	ppm
Potassium	K	-	2.1	ppm
Manganese	Mn	-	L 0.05	ppm
Copper	Cu	-	L 0.005	ppm
Lead	Pb	-	L 0.01	ppm
Zinc	Zn	-	L 0.005	ppm
Total Iron	Fe	-	0.05	ppm
Total Silica	SiO_2	-	18.1	ppm
Total Dissolved Solids		-	472.	ppm
Fixed		-	345.	ppm
Volatile		-	127.	ppm

L = less than

Remarks

Examination of the above results indicated that the water as represented by the submitted sample was characterized as an alkaline, extremely soft but fairly high in dissolved mineralization. The dissolved mineralization was present primarily in the form of sodium bicarbonate and carbonates.

The sample contained a sulfurous odour and subsequent analysis for sulfides indicated that 0.2 ppm sulfide was present in the water.

The water was above the American Public Health Association standard for pH (6.0 - 8.5) and near the maximum (0.2 ppm) for phosphate content. On all other tests conducted the water complied with domestic water standards set by the above authorities.

Prior to its use for drinking purposes we would recommend that the water be tested for its bacteriological purity.

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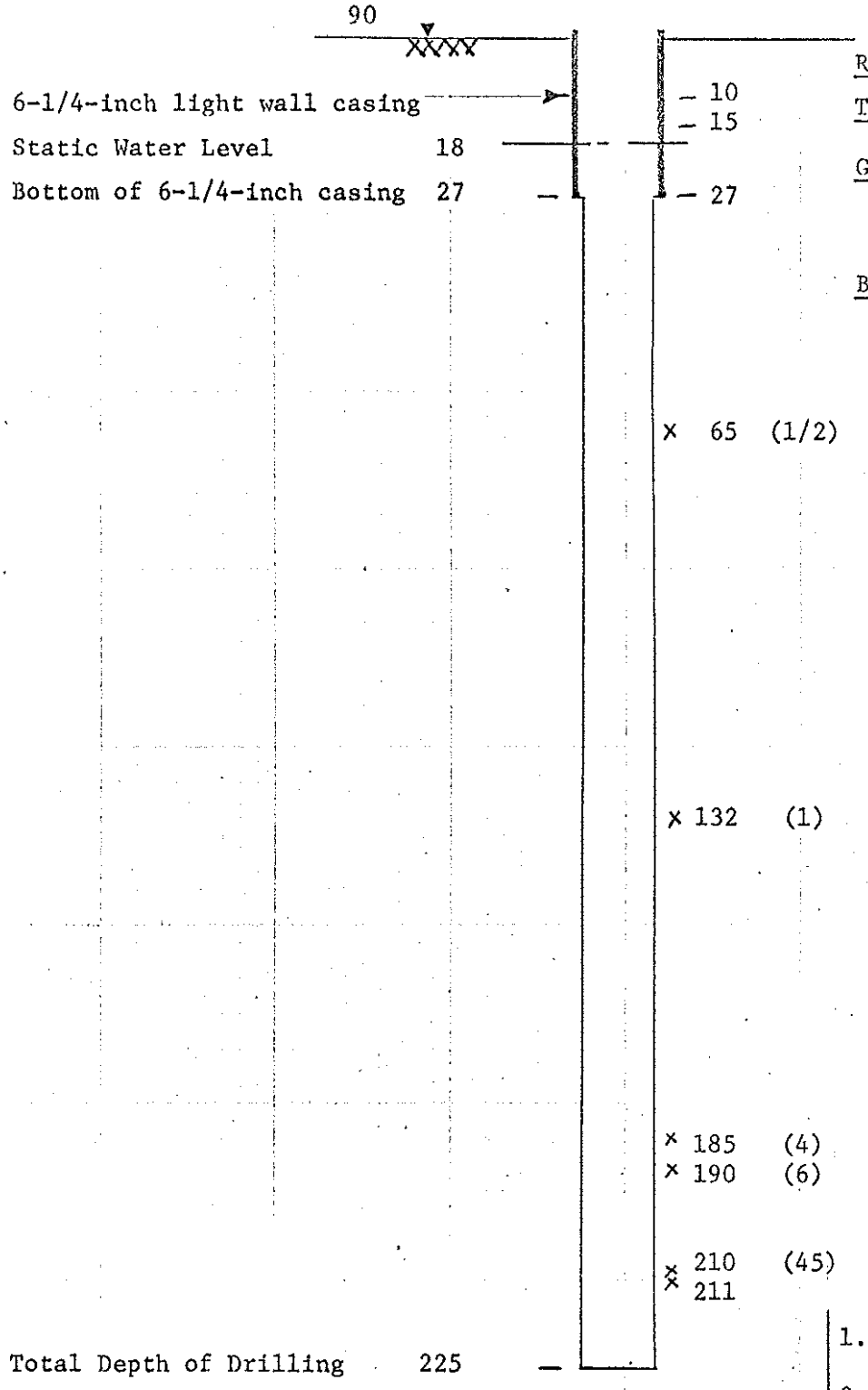
D. K. Dixon

WTN 65965



SCALES

Vertical 1" = 30 feet
Horizontal N.T.S.

NOTATION

1. x = location of fracture in bedrock
2. (1/2) = approx. flow of water blown from hole while drilling; gpm

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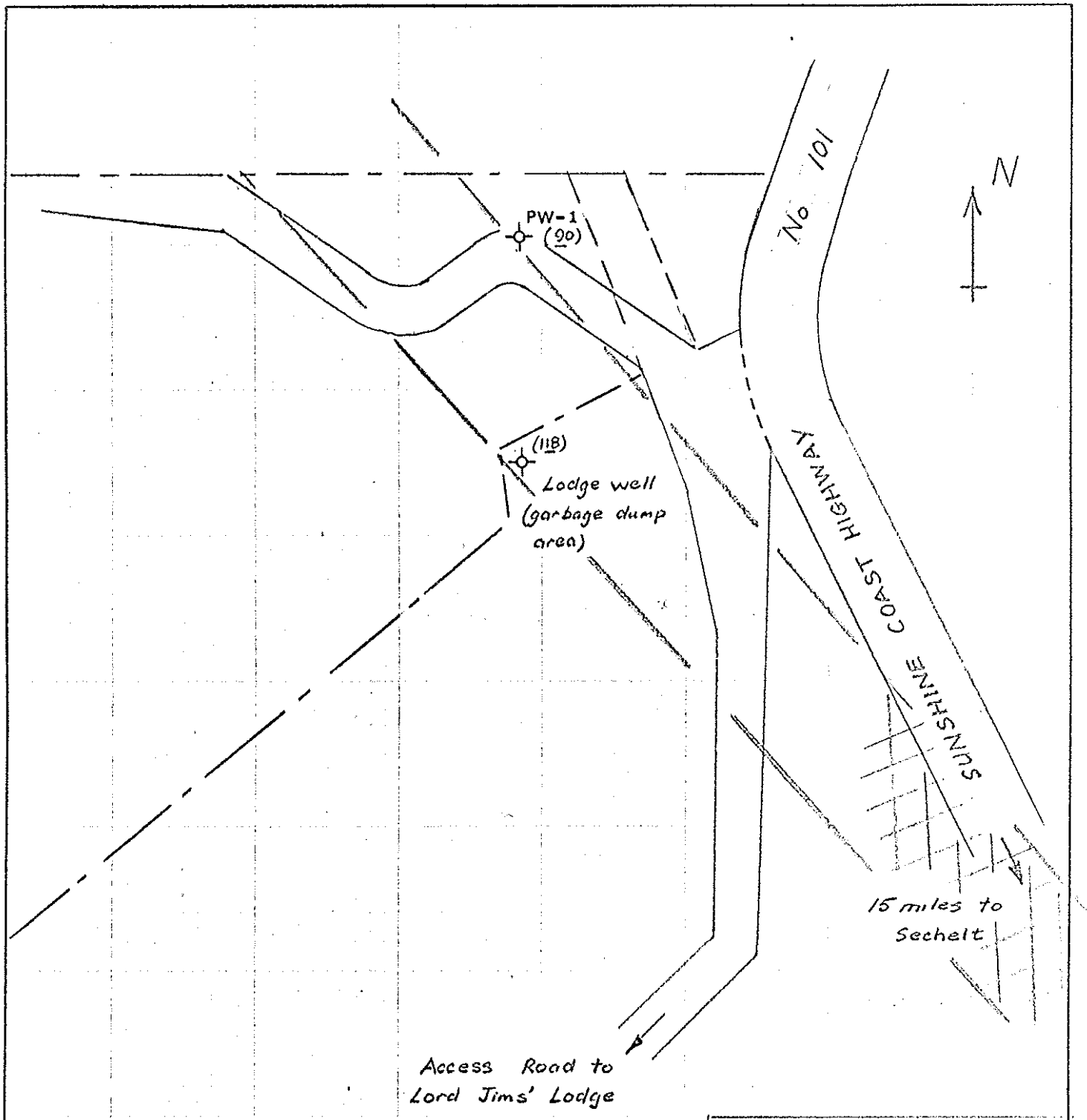
SECHELT PENINSULA, B. C.	PRODUCTION WELL No: 1	May 1972 — Fig: 2



NOTATION

(90) Production Well with ground surface elevation at 90 ft (m.s.l)

Ground surface trace of bedrock fracture.

Property Boundary

SCALE

1-inch = 200 ft

PENINSULA DEVELOPMENT CO.LTD.	WELL LOCATION	ROBINSON, ROBERTS & BROWN LTD. CONSULTING GROUNDWATER GEOLOGISTS NORTH VANCOUVER, CANADA
SECHELT PENINSULA, B. C.	SKETCH MAP	MAY 1972 — Fig: 1