

**WATER WELL
FOR
KUPER ISLAND I.R. #7**

PENELAKUT INDIAN BAND

BY

**W.L. BROWN, P. ENG.
R.B. ERDMAN**

83-337

DECEMBER, 1983

**WATER WELL
FOR
KUPER ISLAND I.R. #7**

PENELAKUT INDIAN BAND

TABLE OF CONTENTS

INTRODUCTION	1
WELL CONSTRUCTION	2
TEST PUMPING	5
WELL HYDROLOGY	6
CHEMICAL ANALYSIS	8
RECOMMENDATION AND CONCLUSION	9

INTRODUCTION

Terms of Reference for investigation, design, construction supervision, and testing of a water well for Kuper Island, I.R. #7, Penelakut Indian Band were circulated in June 1983.

Brown, Erdman & Associates Ltd. presented a proposal which was accepted by the band in September 1983. The existing groundwater reports and files were reviewed and specifications and cost estimates prepared. Five drilling contractors returned bids with the low bidder being Drillwell Enterprises Ltd. of Cowichan Bay, B.C. The drilling contract was awarded on November 16, 1983.

On November 17, 1983, Drillwell moved their equipment onto the Island and started drilling operations. Drilling and development were completed on November 26th and the successful testing of the well completed on December 2, 1983.

R. B. Erdman of the office supervised the drilling, developing and testing of the subject well.

WELL CONSTRUCTION

The Terms of Reference requested a single well that should have a capacity equal to or exceeding 2.2 litres/second (29 Imperial GPM). A 150 mm (6-inch) diameter well was selected to satisfy this water demand. The specifications were prepared in such a manner that the well could be constructed in overburden or in the sandstones that are exposed over much of the Island. The specifications required that drilling be done with an air rotary machine equipped with a drill through casing hammer. (See Figure 1 for well location).

Drillwell Enterprises mobilized a B.E. 2400 Air rotary machine to Kuper Island on November 17, 1983. The same day a 250 mm (10-inch) conductor casing was drilled to a depth of 9.75 m (32 feet). A 200 mm (8-inch) surface casing was then cemented in place. As the conductor casing was being removed from the ground, the annular space was grouted with Portland cement to which three percent bentonite had been added to prevent shrinkage. After the 200 mm casing had been grouted into place, the hole was allowed to stand and the grout set until Monday, November 21, at which time the contractor drilled out below the surface casing with a 200 mm bit. Drilling in the open hole advanced to 18.3 m at which depth the unconsolidated sediments started to sluff into the open hole making further drilling without casing impossible.

The 200 mm hole was cased with 150 mm casing and the hole advanced to a depth of 115.24 m in unconsolidated material. Please see the attached well record for a complete lithologic log of the well.

WELL CONSTRUCTION (Continued)

As can be seen on the well log, there is a thick sequence of unconsolidated material present on Kuper Island. Since bedrock is exposed along most of the island's shoreline, it was very surprising to find that this thickness of sediment is present.

Several, thin, water-bearing sands and gravels are present above the aquifer that was developed. An aquifer, between depths of 45.43 and 47.56 m was considered but from other drill hole information, it was felt that this zone was perched and therefore would not be able to supply the required amount of water. The lower aquifer between depths of 108.23 and 114.63 m has not only the cemented surface casing to protect it from surface or near-surface water contamination, but also a thick clay sequence between depths of 50.30 and 90.85 m.

After the fine to medium sand aquifer between depths of 108.23 and 114.63 m had been drilled and the silty sand and gravel zone encountered below it, drilling was terminated. Sieve analyses of the aquifer samples collected during drilling showed that the sands graded between .38 mm and .25 mm with the coarse fraction being on the top.

The well screen consists of 1.50 m of 0.38 mm slot, 2.45 m of 0.30 mm slot and 1.50 m of 0.25 mm slot stainless steel, wire wound 150 mm telescopic diameter sized screen.

WELL CONSTRUCTION (Continued)

The screen is fitted with a bail bottom and a lead seal packer which is separated from the screen by 0.77 m of blank pipe riser. The total length of the screen assembly is 6.03 m. The bottom of the screen is set at a depth of 113.7 m and the top of the lead seal is at a depth of 107.67 m. The 150 mm diameter casing was pulled back to expose the screen. The bottom of the casing is at a depth of 108.28 m. Please see Figure 2 for construction details.

Development of the well started on Friday, November 25th and was completed on Saturday, November 26th. Development was carried out by surging and blowing with the air compressor on the rig. A very gentle procedure was used in the first stage of the development to prevent the sands from becoming packed against the screen. As the well was developed, more severe agitation was used until at the end of the development an estimated 3 L/sec of clean clear water was being blown from the well.

TEST PUMPING

B.C. Aquifer Testing acting as a sub-contractor to Drillwell Enterprises mobilized the test pumping equipment to Kuper Island on November 28th and set a submissile test pump at a depth of 100 m.

Test pumping started at 11:45, November 29, 1983. The static water level at the start of the test was 51.930 m below the measuring point which is 0.687 m above ground surface. The elevation of the ground surface as determined by altimeter is 58.50 m. During the first ten minutes of the test, a pumping rate of 2.4 L/sec was maintained. During this period, the pumping level dropped to a depth of 54.560 m. Please see the attached pump test data for details. After ten minutes into the test, the pumping rate was increased to 4.068 L/sec at which rate pumping was maintained until the end of the test at 4 400 minutes (73 1/3 hours). After the pump was turned off, recovery water level readings were taken for an additional one hundred twenty minutes (2 hours). The lowest pumping level recorded during the test was 58.238 m. The pumping levels indicate that there is a slight tidal effect on the well. Please see Figure 5.

WELL HYDROLOGY

Figures 3 and 4 show the transmissivity calculations of the aquifer penetrated by the well. Figure 3 is the semi-logarithmic plot of the drawdown against time. Figure 4 is the semi-logarithmic plot of the recovery with residual drawdown plotted against total time since pumping started divided by time since pumping stopped.

The first leg of the drawdown curve gives a transmissivity of 1.59×10^{-3} metres ²/sec (11 000 US GPD/ft.). The transmissivity of the last leg of the drawdown curve is calculated to be 6.6×10^{-4} metres ²/sec. (4 600 US GPD/ft.).

The transmissivity calculated from the recovery curve is the same as that calculated during the first ten minutes of drawdown. The total maximum drawdown recorded during the test was 6.308 m. The total available drawdown is 55.66 m. At the pumping rate of 4.068 L/sec (54 I GPM) the specific capacity of the well is calculated to be 0.64 L/sec/m. (2.6 I GPM/ft.).

At a pumping rate of 2.2 L/sec. the calculated drawdown in the well will be 3.44 m. A review of the pump curves we have available indicates that approximately 4.1 L/sec. can be produced by a single phase pump that will fit into the 150 mm (6-inch) diameter casing.

At a pumping rate of 4.1 L/sec. the calculated drawdown will be 6.406 m. This would place the pumping level at a depth of 58.336 m or slightly above sea level. . It would be recommended that the pump be set at a depth of 70 m to allow for seasonal fluctuations and safety.

WELL HYDROLOGY (Continued)

Figure 5 is an arithmetic plot of the water level drawdown measurements in meters against time in minutes. The main tides are reflected on the graph. This graph also indicates that the water levels reach essential stabilization from pumping and are only reflecting the tide changes during the last 500 minutes of the pump test on December 2, 1983.

CHEMICAL ANALYSIS

The attached chemical analyses show that the water is potable and not contaminated.

RECOMMENDATION AND CONCLUSION

1. The drilling and testing of a water supply well on Kuper Island has been successfully completed.
2. The rated capacity of the well is 4.1 L/sec from a pumping level of 58.336 m. The recommended pump setting is 70 m.
3. The maximum outside diameter of the pump should be 140 mm.
4. The well should not be rawhided, backwashed, or vibrated.
5. Production and water level data should be measured and recorded during the first year of operation. These data should be reviewed by Brown, Erdman & Associates Ltd. to establish the safe productive potential of this well.



KUPER ISLAND - NEW VILLAGE WELL

DEPTH - METRES		LITHOLOGY
From	To	
0	3.96	Silty sand and gravel, some clay
3.96	5.18	Silty sand, fine, blue
5.18	10.67	Silty sand and gravel
10.67	26.83	Sand medium/coarse
26.83	30.18	sand and gravel, damp
30.18	40.85	Clay, silty
40.85	41.78	Silty sand and fine gravel
41.78	45.43	Sand medium/coarse, some silt, water-bearing
45.43	47.56	Sand medium/coarse, clean water-bearing
47.56	50.30	Sand and gravel, some silt
50.30	90.85	Clay grey with few pebbles
90.85	91.77	Sand fine/silt
91.77	96.66	Till
96.66	97.86	Sand and gravel silty
97.86	108.23	Silty sand with clay binders
108.23	114.63	Sand fine/medium clean water-bearing, Static water level 51.93
114.63	115.24	Sand fine/medium with gravel silty T.D.



WELL OWNER Penelakut Indian Band
LOCATION Kuper Island

WELL NO. 1
JOB NO. 83-337

DRAWDOWN
RECOVERY

DATE	TIME	ELAPSED TIME MINUTES	DEPTH TO WATER Metres	Q GPM L/sec.	REMARKS
Nov.29/83	11:45	0	51.930	0	Static water level
	11:45:30	.5	54.421		
	11:46	1	53.695		
	11:46:30	1.5	54.102		
	11:47	2	54.360		
	11:47:30	2.5	54.415		
	11:48	3	54.450	2.4	
	11:48:30	3.5	54.471	2.4	
	11:49	4	54.480	2.4	
	11:49:30	4.5	54.495	2.4	
	11:50	5	54.506	2.4	
	11:51	6	54.527	2.4	
	11:52	7	54.528	2.4	
	11:53	8	54.540	2.4	
	11:54	9	54.560	2.4	
	11:55	10	54.575	2.4	
	11:57	12	55.600	3.47	
	11:59	14	55.635	3.47	
	12:01	16	56.250	4.068	
	12:03	18	56.259	4.068	
	12:05	20	56.285	4.068	
	12:10	25	56.390	4.068	
	12:15	30	56.435	4.068	
	12:20	35	56.460	4.068	
	12:25	40	56.475	4.068	
	12:30	45	56.500	4.068	
	12:35	50	56.511	4.068	
	12:45	60	56.540	4.068	H ₂ O sample, bact.-sample
	12:55	70	56.520?	4.068	Temp 11 deg. C.
	13:05	80	56.570	4.068	
	13:15	90	56.591	4.068	
	13.25	100	56.605	4.068	



WELL OWNER Penelakut Indian Band
LOCATION Kuper Island

WELL NO. 1 DRAWDOWN
JOB NO. 83-337 RECOVERY

DATE	TIME	ELAPSED TIME MINUTES	DEPTH TO WATER Metres	Q GPM L/sec.	REMARKS
Nov.29/83	13:50	125	56.630	4.068	
	14:15	150	56.647	4.068	
	15:05	200	56.686	4.068	Temp. 11 Deg. C.
	15:55	250	56.719	4.068	
	16:45	300	56.777	4.068	Temp. 11 Deg. C.
	17:35	350	56.831	4.068	
	18:25	400	56.923	4.068	Temp. 11 Deg. C.
	19:15	450	56.990	4.068	
	20:05	500	57.043	4.068	Temp. 11 Deg. C.
	20:55	550	57.153	4.068	
	21:45	600	57.174	4.068	
	22:35	650	57.197	4.068	
	23:25	700	57.232	4.068	
Nov.30/83	00:15	750	57.252	4.068	
	01:05	800	57.257	4.068	
	01:55	850	57.265	4.068	
	02:45	900	57.305	4.068	Temp. 11 Deg. C.
	03:35	950	57.315	4.068	
	04:25	1000	57.322	4.068	
	05:15	1050	57.365	4.068	
	06:05	1100	57.400	4.068	
	06:55	1150	57.425	4.068	
	07:45	1200	57.420	4.068	Temp. 11 Deg. C.
	08:35	1250	57.500	4.068	
	09:25	1300	57.517	4.068	
	10:15	1350	57.523	4.068	
	11:05	1400	57.523	4.068	
	11:55	1450	57.501	4.068	
	12:45	1500	57.438	4.068	
	13:35	1550	57.413	4.068	
	14:25	1600	57.412	4.068	
	15:15	1650	57.412	4.068	



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JOB NO. 83-337 RECOVERY

DATE	TIME	ELAPSED TIME MINUTES	DEPTH TO WATER Metres	Q GPM L/sec.	REMARKS
Nov.30/83	16:05	1700	57.418	4.068	
	16:55	1750	57.428	4.068	
	17:45	1800	57.459	4.068	Temp. 11 Deg. C.
	18:35	1850	57.533	4.068	
	19:25	1900	57.586	4.068	
	20:15	1950	57.642	4.068	
	21:05	2000	57.710	4.068	
	21:55	2050	57.755	4.068	
	22:45	2100	57.797	4.068	
	23:35	2150	57.822	4.068	
Dec.2/83	00:25	2200	57.829	4.068	
	01:15	2250	57.830	4.068	
	02:05	2300	57.828	4.068	
	02:55	2350	57.815	4.068	
	03:45	2400	57.800	4.068	
	04:35	2450	57.796	4.068	
	05:25	2500	57.805	4.068	
	06:15	2550	57.814	4.068	
	07:05	2600	57.814	4.068	
	07:55	2650	57.860	4.068	
	08:45	2700	57.885	4.068	
	09:35	2750	57.909	4.068	
	10:25	2800	57.911	4.068	
	11:15	2850	57.905	4.068	
	12:05	2900	57.895	4.068	
	12:55	2950	57.860	4.068	
	13:45	3000	57.840	4.068	
	14:35	3050	57.813	4.068	
	15:25	3100	57.800	4.068	
	16:15	3150	57.795	4.068	
	17:05	3200	57.800	4.068	
	17:55	3250	57.843	4.068	



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DATE	TIME	ELAPSED TIME MINUTES	DEPTH TO WATER Metres	Q GPM	T /T'	REMARKS
Dec2/83	13:05	0	58.100			Pump
	13:05:30	.5	55.000		8801	
	13:06	1	54.225		4401	
	13:06:30	1.5	54.036		2934	
	13:07	2	53.950		2201	
	13:07:30	2.5	53.890		1761	
	13:08	3	53.885		1467	
	13:08:30	3.5	53.820		1258	
	13:09	4	53.795		1101	
	13:09:30	4.5	53.780		980	
	13:10	5	53.761		881	
	13:11	6	53.729		734	
	13:12	7	53.695		629	
	13:13	8	53.671		551	
	13:14	9	53.644		490	
	13:15	10	53.626		441	
	13:17	12	53.591		368	
	13:19	14	53.557		315	
	13:21	16	53.530		276	
	13:23	18	53.502		245	
	13:25	20	53.481		221	
	13:30	25	53.435		117	
	13:35	30	53.393		148	
	13:40	35	53.361		127	
	13:45	40	53.336		110	
	13:50	45	53.315		99	
	13:55	50	53.291		89	
	14:05	60	53.255		74	
	14:15	70	53.225		64	
	14:25	80	53.190		56	
	14:35	90	53.162		50	
	14:45	100	53.138		45	
	15:05	120	53.125		37.6	

ASL

analytical service laboratories ltd.

1650 pandora st · vancouver, b.c. · V5L 1L6
(604) 253-4188

DEC 20 1983

Report On: Water Analysis

File #: 681A

Report To: Brown Erdman & Associates
1401 Bewicke Ave.
North Vancouver, B.C.
V7M 3G7

Date: Dec. 15, 1983

Your Project: 83-337

We have analysed the water samples submitted on Dec. 1 & 5/83 and report as follows:

SAMPLE INFORMATION

The samples were submitted in proper laboratory containers labelled:

#1 Kuper Island Nov. 29/83 12:45
#2 Kuper Island Dec. 2/83

METHOD OF ANALYSIS

The analyses were carried out using procedures specified by the B.C. Ministry of the Environment.

RESULTS

See attached table.

REMARKS

The samples as represented by the samples submitted can be characterized as moderate with respect to mineralization. The samples met Canadian Drinking water standards for all parameters except manganese which was slightly above the limit of 0.05 ppm. Manganese is limited for aesthetic reasons rather than health considerations.

ASL ANALYTICAL SERVICE LABORATORIES LTD.



A.W. Maynard, M.Sc.
Senior Partner

AWM:sis

RESULTS OF ANALYSIS

PARAMETER

	681-1	682-2
Physical Parameters		
pH		8.30
Specific Conductance (umhos/cm)		269.
Color (CU)		L5.
Turbidity (JTU)		L1.
Dissolved Solids (mg/L)	200.	197.
Total Hardness -CaCO ₃ (mg/L)		113.
Dissolved Anions (mg/L)		
Bicarbonate HCO ₃		110.
Carbonate CO ₃		NIL
Chloride Cl	18.1	12.8
Sulfate SO ₄		3.8
Fluoride F		0.13
Nitrate + Nitrite N		L0.005
Dissolved Metals (mg/L)		
Calcium Ca		32.4
Magnesium Mg		7.81
Sodium Na	25.8	20.0
Iron Fe		L0.03
Manganese Mn		0.070
Silicon SiO ₂		22.7
Total Metals (mg/L)		
Iron Fe		L0.030
Manganese Mn		0.079
Coliform Bacteria		
Total		Not detected
Fecal		Not detected

L = Less than

mg/L = milligrams per litre (ppm)



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From	To	
0	3.96	Silty sand and gravel, some clay
3.96	5.18	Silty sand, fine, blue
5.18	10.67	Silty sand and gravel
10.67	26.83	Sand medium/coarse
26.83	30.18	sand and gravel, damp
30.18	40.85	Clay, silty
40.85	41.78	Silty sand and fine gravel
41.78	45.43	Sand medium/coarse, some silt, water-bearing
45.43	47.56	Sand medium/coarse, clean water-bearing
47.56	50.30	Sand and gravel, some silt
50.30	90.85	Clay grey with few pebbles
90.85	91.77	Sand fine/silt
91.77	96.66	Till
96.66	97.86	Sand and gravel silty
97.86	108.23	Silty sand with clay binders
108.23	114.63	Sand fine/medium clean water-bearing, Static water level 51.93
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WELL OWNER Penelakut Indian Band
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JOB NO. 83-337 RECOVERY

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	12:20	35	56.460	4.068	
	12:25	40	56.475	4.068	
	12:30	45	56.500	4.068	
	12:35	50	56.511	4.068	
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	23:25	700	57.232	4.068	
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	03:35	950	57.315	4.068	
	04:25	1000	57.322	4.068	
	05:15	1050	57.365	4.068	
	06:05	1100	57.400	4.068	
	06:55	1150	57.425	4.068	
	07:45	1200	57.420	4.068	Temp. 11 Deg. C.
	08:35	1250	57.500	4.068	
	09:25	1300	57.517	4.068	
	10:15	1350	57.523	4.068	
	11:05	1400	57.523	4.068	
	11:55	1450	57.501	4.068	
	12:45	1500	57.438	4.068	
	13:35	1550	57.413	4.068	
	14:25	1600	57.412	4.068	
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DATE	TIME	ELAPSED TIME MINUTES	DEPTH TO WATER Metres	Q GPM L/sec.	REMARKS
Nov.30/83	16:05	1700	57.418	4.068	
	16:55	1750	57.428	4.068	
	17:45	1800	57.459	4.068	Temp. 11 Deg. C.
	18:35	1850	57.533	4.068	
	19:25	1900	57.586	4.068	
	20:15	1950	57.642	4.068	
	21:05	2000	57.710	4.068	
	21:55	2050	57.755	4.068	
	22:45	2100	57.797	4.068	
Dec.2/83	23:35	2150	57.822	4.068	
	00:25	2200	57.829	4.068	
	01:15	2250	57.830	4.068	
	02:05	2300	57.828	4.068	
	02:55	2350	57.815	4.068	
	03:45	2400	57.800	4.068	
	04:35	2450	57.796	4.068	
	05:25	2500	57.805	4.068	
	06:15	2550	57.814	4.068	
	07:05	2600	57.814	4.068	
	07:55	2650	57.860	4.068	
	08:45	2700	57.885	4.068	
	09:35	2750	57.909	4.068	
	10:25	2800	57.911	4.068	
	11:15	2850	57.905	4.068	
12:05	2900	57.895	4.068		
12:55	2950	57.860	4.068		
13:45	3000	57.840	4.068		
14:35	3050	57.813	4.068		
15:25	3100	57.800	4.068		
16:15	3150	57.795	4.068		
17:05	3200	57.800	4.068		
17:55	3250	57.843	4.068		



WELL OWNER Penelakut Indian Band
LOCATION Kuper Island

WELL NO. 1 DRAWDOWN
JOB NO. 83-337 RECOVERY

DATE	TIME	ELAPSED TIME MINUTES	DEPTH TO WATER Metres	Q		REMARKS
				GPM	T /T'	
Dec2/83	13:05	0	58.100			Pump
	13:05:30	.5	55.000		8801	
	13:06	1	54.225		4401	
	13:06:30	1.5	54.036		2934	
	13:07	2	53.950		2201	
	13:07:30	2.5	53.890		1761	
	13:08	3	53.885		1467	
	13:08:30	3.5	53.820		1258	
	13:09	4	53.795		1101	
	13:09:30	4.5	53.780		980	
	13:10	5	53.761		881	
	13:11	6	53.729		734	
	13:12	7	53.695		629	
	13:13	8	53.671		551	
	13:14	9	53.644		490	
	13:15	10	53.626		441	
	13:17	12	53.591		368	
	13:19	14	53.557		315	
	13:21	16	53.530		276	
	13:23	18	53.502		245	
	13:25	20	53.481		221	
	13:30	25	53.435		117	
	13:35	30	53.393		148	
	13:40	35	53.361		127	
	13:45	40	53.336		110	
	13:50	45	53.315		99	
	13:55	50	53.291		89	
	14:05	60	53.255		74	
	14:15	70	53.225		64	
	14:25	80	53.190		56	
	14:35	90	53.162		50	
	14:45	100	53.138		45	
	15:05	120	53.125		37.6	

ASL

analytical service Laboratories Ltd.

1650 pandora st · vancouver, b.c. · V5L 1L6
(604) 253-4188

DEC 20 1983

Report On: Water Analysis

File #: 681A

Report To: Brown Erdman & Associates
1401 Bewicke Ave.
North Vancouver, B.C.
V7M 3G7

Date: Dec. 15, 1983

Your Project: 83-337

We have analysed the water samples submitted on Dec. 1 & 5/83 and report as follows:

SAMPLE INFORMATION

The samples were submitted in proper laboratory containers labelled:

#1 Kuper Island Nov. 29/83 12:45
#2 Kuper Island Dec. 2/83

METHOD OF ANALYSIS

The analyses were carried out using procedures specified by the B.C. Ministry of the Environment.

RESULTS

See attached table.

REMARKS

The samples as represented by the samples submitted can be characterized as moderate with respect to mineralization. The samples met Canadian Drinking water standards for all parameters except manganese which was slightly above the limit of 0.05 ppm. Manganese is limited for aesthetic reasons rather than health considerations.

ASL ANALYTICAL SERVICE LABORATORIES LTD.



A.W. Maynard, M.Sc.
Senior Partner

AWM:sis

RESULTS OF ANALYSIS

PARAMETER

	681-1	682-2
Physical Parameters		
pH		8.30
Specific Conductance (umhos/cm)		269.
Color (CU)		L5.
Turbidity (JTU)		L1.
Dissolved Solids (mg/L)	200.	197.
Total Hardness -CaCO ₃ (mg/L)		113.
Dissolved Anions (mg/L)		
Bicarbonate HCO ₃		110.
Carbonate CO ₃		NIL
Chloride Cl	18.1	12.8
Sulfate SO ₄		3.8
Fluoride F		0.13
Nitrate + Nitrite N		L0.005
Dissolved Metals (mg/L)		
Calcium Ca		32.4
Magnesium Mg		7.81
Sodium Na	25.8	20.0
Iron Fe		L0.03
Manganese Mn		0.070
Silicon SiO ₂		22.7
Total Metals (mg/L)		
Iron Fe		L0.030
Manganese Mn		0.079
Coliform Bacteria		
Total		Not detected
Fecal		Not detected

L = Less than

mg/L = milligrams per litre (ppm)



WELL OWNER Penelakut Indian Band
LOCATION Kuper Island

WELL NO. 1
JOB NO. 83-337

DRAWDOWN
RECOVERY

DATE	TIME	ELAPSED TIME MINUTES	DEPTH TO WATER Metres	Q GPM L/sec.	REMARKS
Nov.29/83	11:45	0	51.930	0	Static water level
	11:45:30	.5	54.421		
	11:46	1	53.695		
	11:46:30	1.5	54.102		
	11:47	2	54.360		
	11:47:30	2.5	54.415		
	11:48	3	54.450	2.4	
	11:48:30	3.5	54.471	2.4	
	11:49	4	54.480	2.4	
	11:49:30	4.5	54.495	2.4	
	11:50	5	54.506	2.4	
	11:51	6	54.527	2.4	
	11:52	7	54.528	2.4	
	11:53	8	54.540	2.4	
	11:54	9	54.560	2.4	
	11:55	10	54.575	2.4	
	11:57	12	55.600	3.47	
	11:59	14	55.635	3.47	
	12:01	16	56.250	4.068	
	12:03	18	56.259	4.068	
	12:05	20	56.285	4.068	
	12:10	25	56.390	4.068	
	12:15	30	56.435	4.068	
	12:20	35	56.460	4.068	
	12:25	40	56.475	4.068	
	12:30	45	56.500	4.068	
	12:35	50	56.511	4.068	
	12:45	60	56.540	4.068	H ₂ O sample, bact.-sample
	12:55	70	56.520?	4.068	Temp 11 deg. C.
	13:05	80	56.570	4.068	
	13:15	90	56.591	4.068	
	13:25	100	56.605	4.068	



WELL OWNER Penelakut Indian Band
LOCATION Kuper Island

WELL NO. 1 DRAWDOWN
JOB NO. 83-337 RECOVERY

DATE	TIME	ELAPSED TIME MINUTES	DEPTH TO WATER Metres	Q GPM L/sec.	REMARKS
Nov.29/83	13:50	125	56.630	4.068	
	14:15	150	56.647	4.068	
	15:05	200	56.686	4.068	Temp. 11 Deg. C.
	15:55	250	56.719	4.068	
	16:45	300	56.777	4.068	Temp. 11 Deg. C.
	17:35	350	56.831	4.068	
	18:25	400	56.923	4.068	Temp. 11 Deg. C.
	19:15	450	56.990	4.068	
	20:05	500	57.043	4.068	Temp. 11 Deg. C.
	20:55	550	57.153	4.068	
	21:45	600	57.174	4.068	
	22:35	650	57.197	4.068	
	23:25	700	57.232	4.068	
Nov.30/83	00:15	750	57.252	4.068	
	01:05	800	57.257	4.068	
	01:55	850	57.265	4.068	
	02:45	900	57.305	4.068	Temp. 11 Deg. C.
	03:35	950	57.315	4.068	
	04:25	1000	57.322	4.068	
	05:15	1050	57.365	4.068	
	06:05	1100	57.400	4.068	
	06:55	1150	57.425	4.068	
	07:45	1200	57.420	4.068	Temp. 11 Deg. C.
	08:35	1250	57.500	4.068	
	09:25	1300	57.517	4.068	
	10:15	1350	57.523	4.068	
	11:05	1400	57.523	4.068	
	11:55	1450	57.501	4.068	
	12:45	1500	57.438	4.068	
	13:35	1550	57.413	4.068	
	14:25	1600	57.412	4.068	
	15:15	1650	57.412	4.068	



WELL OWNER Penelakut Indian Band
LOCATION Kuper Island

WELL NO. 1 DRAWDOWN
JOB NO. 83-337 RECOVERY

DATE	TIME	ELAPSED TIME MINUTES	DEPTH TO WATER Metres	Q GPM L/sec.	REMARKS
Nov.30/83	16:05	1700	57.418	4.068	
	16:55	1750	57.428	4.068	
	17:45	1800	57.459	4.068	Temp. 11 Deg. C.
	18:35	1850	57.533	4.068	
	19:25	1900	57.586	4.068	
	20:15	1950	57.642	4.068	
	21:05	2000	57.710	4.068	
	21:55	2050	57.755	4.068	
	22:45	2100	57.797	4.068	
	23:35	2150	57.822	4.068	
Dec.2/83	00:25	2200	57.829	4.068	
	01:15	2250	57.830	4.068	
	02:05	2300	57.828	4.068	
	02:55	2350	57.815	4.068	
	03:45	2400	57.800	4.068	
	04:35	2450	57.796	4.068	
	05:25	2500	57.805	4.068	
	06:15	2550	57.814	4.068	
	07:05	2600	57.814	4.068	
	07:55	2650	57.860	4.068	
	08:45	2700	57.885	4.068	
	09:35	2750	57.909	4.068	
	10:25	2800	57.911	4.068	
	11:15	2850	57.905	4.068	
	12:05	2900	57.895	4.068	
	12:55	2950	57.860	4.068	
	13:45	3000	57.840	4.068	
	14:35	3050	57.813	4.068	
	15:25	3100	57.800	4.068	
	16:15	3150	57.795	4.068	
	17:05	3200	57.800	4.068	
	17:55	3250	57.843	4.068	



WELL OWNER Penelakut Indian Band
LOCATION Kuper Island

WELL NO. 1 DRAWDOWN
JOB NO. 83-337 RECOVERY

DATE	TIME	ELAPSED TIME MINUTES	DEPTH TO WATER Metres	Q		REMARKS
				GPM	T /T'	
Dec2/83	13:05	0	58.100			Pump
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	13:45	40	53.336		110	
	13:50	45	53.315		99	
	13:55	50	53.291		89	
	14:05	60	53.255		74	
	14:15	70	53.225		64	
	14:25	80	53.190		56	
	14:35	90	53.162		50	
	14:45	100	53.138		45	
	15:05	120	53.125		37.6	

ASL

analytical service laboratories ltd.

1650 pandora st · vancouver, b.c. · V5L 1L6
(604) 253-4188

DEC 29 1983

Report On: Water Analysis

File #: 681A

Report To: Brown Erdman & Associates
1401 Bewicke Ave.
North Vancouver, B.C.
V7M 3G7

Date: Dec. 15, 1983

Your Project: 83-337

We have analysed the water samples submitted on Dec. 1 & 5/83 and report as follows:

SAMPLE INFORMATION

The samples were submitted in proper laboratory containers labelled:

#1 Kuper Island Nov. 29/83 12:45
#2 Kuper Island Dec. 2/83

METHOD OF ANALYSIS

The analyses were carried out using procedures specified by the B.C. Ministry of the Environment.

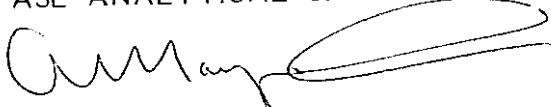
RESULTS

See attached table.

REMARKS

The samples as represented by the samples submitted can be characterized as moderate with respect to mineralization. The samples met Canadian Drinking water standards for all parameters except manganese which was slightly above the limit of 0.05 ppm. Manganese is limited for aesthetic reasons rather than health considerations.

ASL ANALYTICAL SERVICE LABORATORIES LTD.



A.W. Maynard, M.Sc.
Senior Partner

AWM:sis

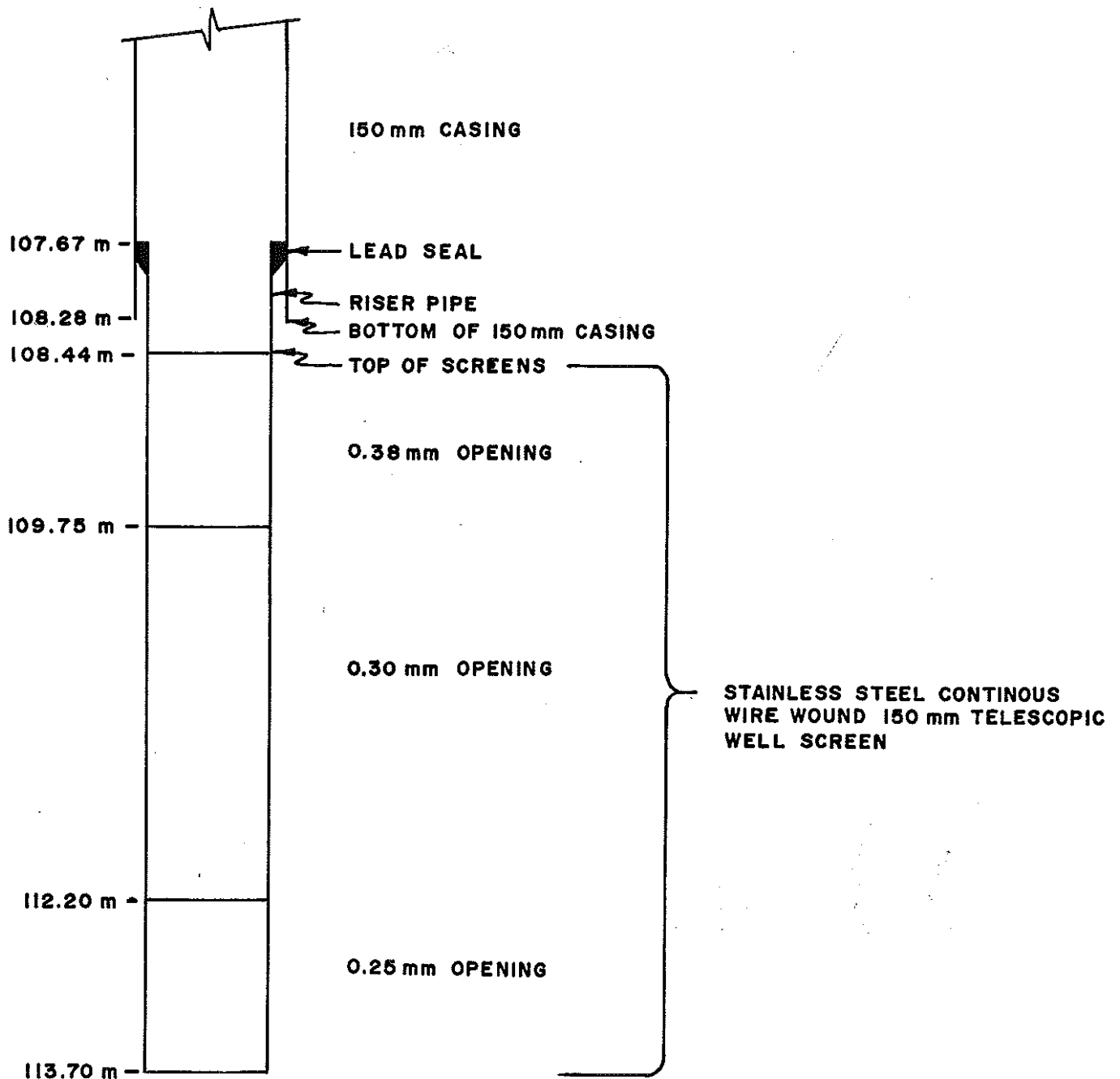
RESULTS OF ANALYSIS

PARAMETER

Physical Parameters	681-1	682-2
pH		8.30
Specific Conductance (umhos/cm)		269.
Color (CU)		L5.
Turbidity (JTU)		L1.
Dissolved Solids (mg/L)	200.	197.
Total Hardness -CaCO ₃ (mg/L)		113.
Dissolved Anions (mg/L)		
Bicarbonate HCO ₃		110.
Carbonate CO ₃		NIL
Chloride Cl ⁻	18.1	12.8
Sulfate SO ₄		3.8
Fluoride F ⁻		0.13
Nitrate + Nitrite N		L0.005
Dissolved Metals (mg/L)		
Calcium Ca		32.4
Magnesium Mg		7.81
Sodium Na	25.8	20.0
Iron Fe		L0.03
Manganese Mn		0.070
Silicon SiO ₂		22.7
Total Metals (mg/L)		
Iron Fe		L0.030
Manganese Mn		0.079
Coliform Bacteria		
Total		Not detected
Fecal		Not detected

L = Less than

mg/L = milligrams per litre (ppm)



PENELAKUT BAND

DETAIL WELL CONSTRUCTION
KUPER ISLAND I.R. NO. 7



BROWN, ERDMAN & ASSOCIATES LTD.
INTERNATIONAL GROUNDWATER CONSULTANTS
NORTH VANCOUVER, BRITISH COLUMBIA

DATE	PROJECT	BY	FIGURE NO.
10-12-83	83-337	WLB	2



analytical service laboratories ltd.

1650 pandora st · vancouver, b.c. · V5L 1L6
(604) 253-4188

Report On: Water Analysis

File #: 681A

Report To: Brown Erdman & Associates
1401 Bewicke Ave.
North Vancouver, B.C.
V7M 3G7

Date: Dec. 15, 1983

Your Project: 83-337

We have analysed the water samples submitted on Dec. 1 & 5/83 and report as follows:

SAMPLE INFORMATION

The samples were submitted in proper laboratory containers labelled:

#1 Kuper Island Nov. 29/83 12:45
#2 Kuper Island Dec. 2/83

METHOD OF ANALYSIS

The analyses were carried out using procedures specified by the B.C. Ministry of the Environment.

RESULTS

See attached table.

REMARKS

The samples as represented by the samples submitted can be characterized as moderate with respect to mineralization. The samples met Canadian Drinking water standards for all parameters except manganese which was slightly above the limit of 0.05 ppm. Manganese is limited for aesthetic reasons rather than health considerations.

ASL ANALYTICAL SERVICE LABORATORIES LTD.

A.W. Maynard, M.Sc.
Senior Partner

AWM:sis

RESULTS OF ANALYSIS

PARAMETER

Physical Parameters	681-1	682-2
pH		8.30
Specific Conductance (umhos/cm)		269.
Color (CU)		L5.
Turbidity (JTU)		L1.
Dissolved Solids (mg/L)	200.	197.
Total Hardness -CaCO ₃ (mg/L)		113.

Dissolved Anions (mg/L)

Bicarbonate	HCO ₃		110.
Carbonate	CO ₃		NIL
Chloride	Cl ³	18.1	12.8
Sulfate	SO ₄		3.8
Fluoride	F ⁴		0.13
Nitrate + Nitrite N			L0.005

Dissolved Metals (mg/L)

Calcium	Ca		32.4
Magnesium	Mg		7.81
Sodium	Na	25.8	20.0
Iron	Fe		L0.03
Manganese	Mn		0.070
Silicon	SiO ₂		22.7

Total Metals (mg/L)

Iron	Fe		L0.030
Manganese	Mn		0.079

Coliform Bacteria

Total	Not detected
Fecal	Not detected

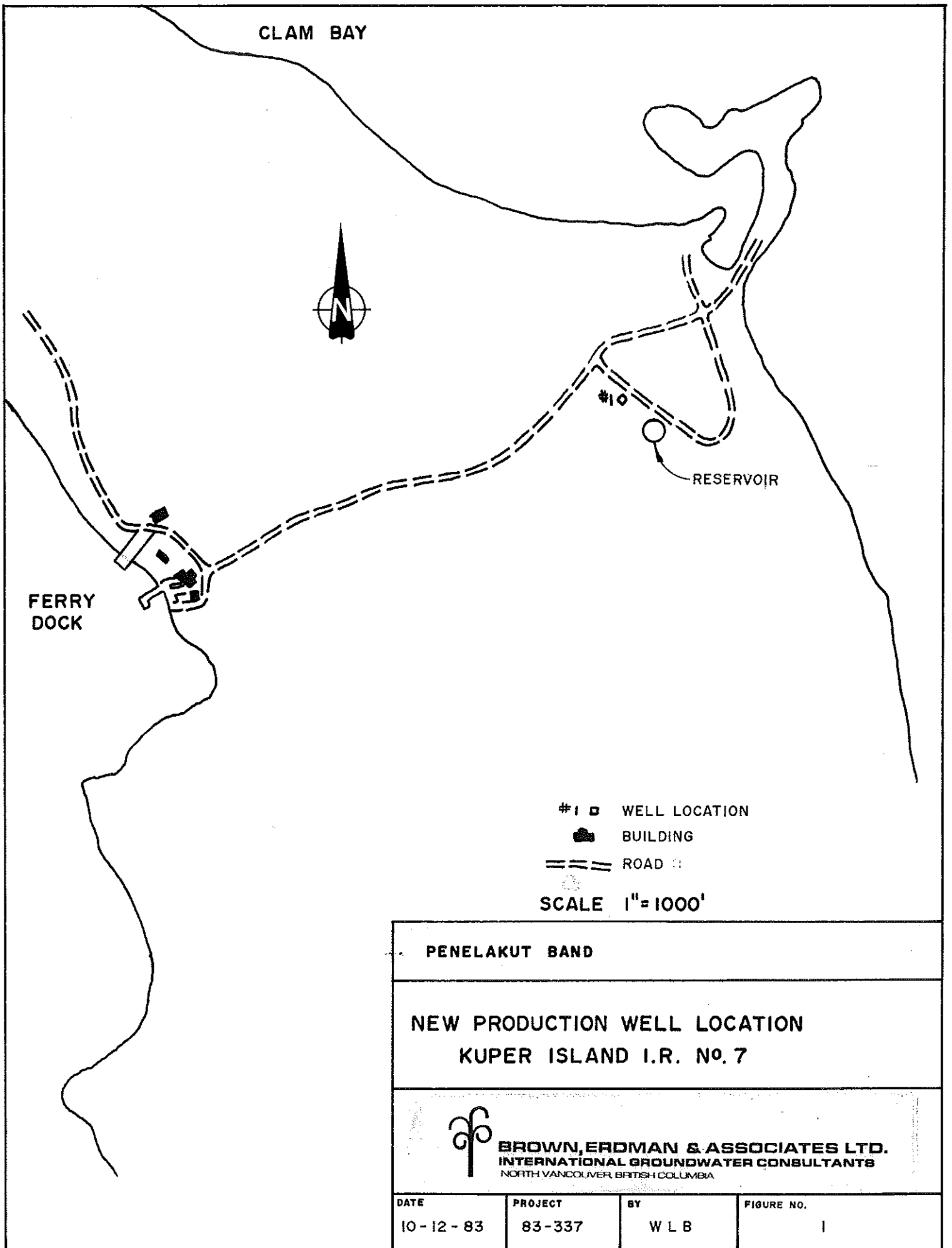
L = Less than

mg/L = milligrams per litre (ppm)




KUPER ISLAND - NEW VILLAGE WELL

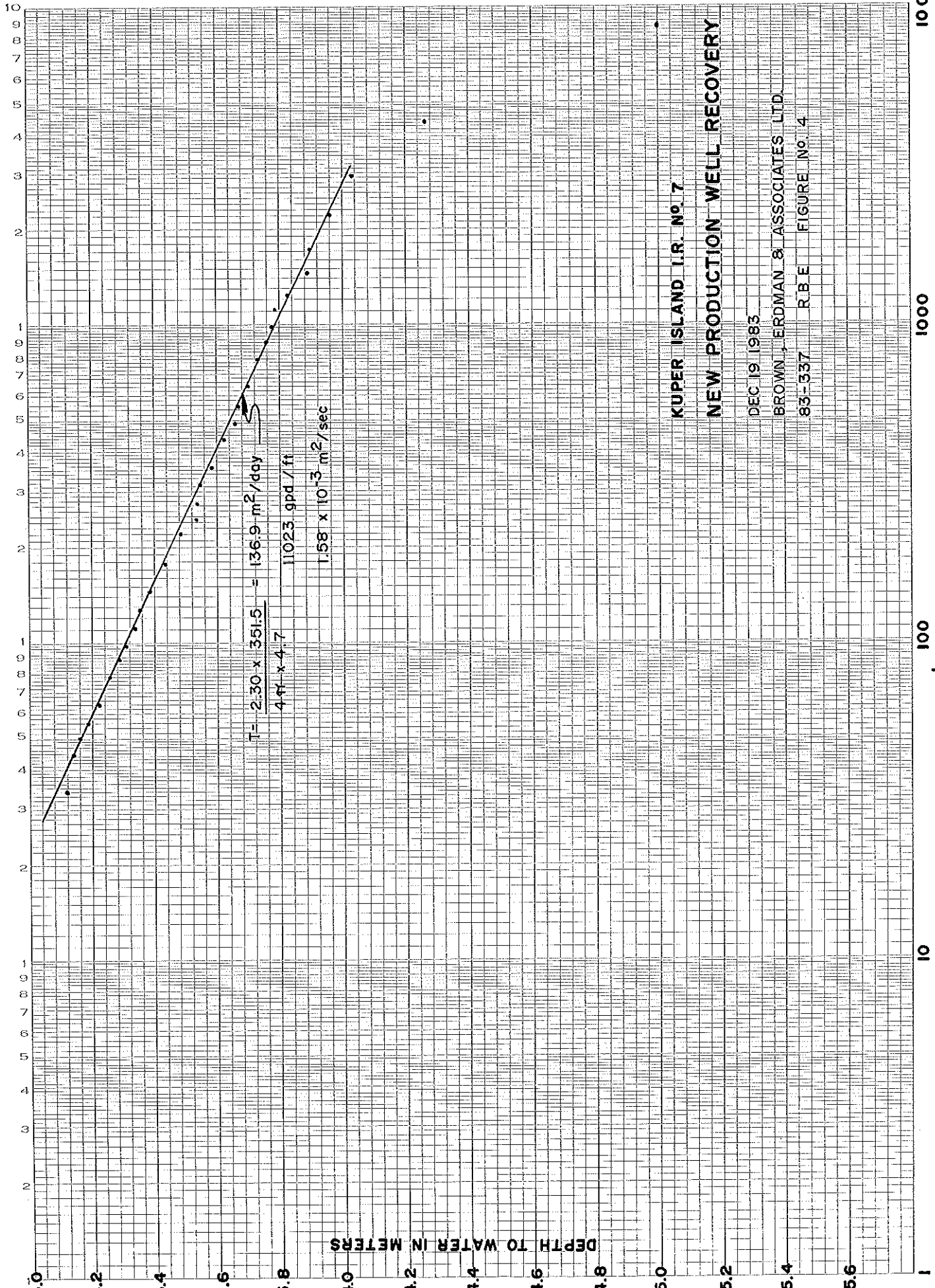
DEPTH - METRES		LITHOLOGY
From	To	
0	3.96	Silty sand and gravel, some clay
3.96	5.18	Silty sand, fine, blue
5.18	10.67	Silty sand and gravel
10.67	26.83	Sand medium/coarse
26.83	30.18	sand and gravel, damp
30.18	40.85	Clay, silty
40.85	41.78	Silty sand and fine gravel
41.78	45.43	Sand medium/coarse, some silt, water-bearing
45.43	47.56	Sand medium/coarse, clean water-bearing
47.56	50.30	Sand and gravel, some silt
50.30	90.85	Clay grey with few pebbles
90.85	91.77	Sand fine/silt
91.77	96.66	Till
96.66	97.86	Sand and gravel silty
97.86	108.23	Silty sand with clay binders
108.23	114.63	Sand fine/medium clean water-bearing, Static water level 51.93
114.63	115.24	Sand fine/medium with gravel silty T.D.



- #1 □ WELL LOCATION
- BUILDING
- == ROAD ==

SCALE 1" = 1000'

PENELAKUT BAND			
NEW PRODUCTION WELL LOCATION KUPER ISLAND I.R. NO. 7			
 BROWN, ERDMAN & ASSOCIATES LTD. INTERNATIONAL GROUNDWATER CONSULTANTS <small>NORTH VANCOUVER, BRITISH COLUMBIA</small>			
DATE	PROJECT	BY	FIGURE NO.
10-12-83	83-337	W L B	1



KUPER ISLAND I.R. No. 7

NEW PRODUCTION WELL RECOVERY

DEC 19 1983

BROWN, ERDMAN & ASSOCIATES LTD

83-337 RBE FIGURE No. 4