GROUNDWATER SUPPLY

FOR

PROPOSED SUBDIVISION OF REMAINDER

LOT 12 SOUTHEAST ¼ SECTION 11

TOWNSHIP 19 PLAN 40750 N.W.D.

for

MR. HAROLD DARBYSHIRE

W.L. BROWN, P. Eng.

R.B. ERDMAN

83-331

July, 1983

1.0 INTRODUCTION

1.1 General Statement

Brown, Erdman & Associates was retained to supervise a pump test conducted on a new water well completed on the proposed subdivision of the Remainder of Lot 11, Southeast ¼, Section 11, Township 19, Plan 40750 N.W.D. A report on the pump test, including the analysis of the test results was also to be prepared in accordance with the District of Abbotsford Criteria for Determining Adequacy of Potable Water Supply in RR-2 and RR-3 Zones (Revision date May 10, 1982).

It is proposed to subdivide the land described above into three lots, each being slightly over 4.0 hectares (10 acres) in areal extent. The new well with appropriate storage will be used to supply potable water to all three lots.

Brown, Erdman & Associates Ltd. did not locate, design or supervise the construction of the well.

1.2 General Description of Work

A 150 mm (6-inch) diameter well was drilled to a depth of 43.6 meters (143 feet). The well was pump tested for 4400 minutes (73 hours 20 minutes) at a discharge rate of .91 l/s (14.4 US gpm). Water samples were collected for chemical and bacteria analyses immediately before the end of the pump test.

2.0 LOCATION

The subject property is situated at 39808 Old Yale Road, on the northwest facing flank of Vedder Mountain. The attached 1:25,000 scale topographic map shows the location of the study property in relation to the topography of Vedder Mountain and the roads in the area.

A 1-inch=100 feet plot plan shows the position of the present house, the new well, the septic field and the two surface creeks. The well is situated approximately 40 meters (125 feet) from the septic field. The surface elevation of the well head is approximately 30 meters A.S.L.

3.0 CONSTRUCTION

The upper 8.23 meters of the well was drilled with a cable tool machine and 150 mm diameter casing was set to this depth. From 8.23 meters to the total depth of 43.6 meters, the well was drilled by air rotary method and is uncased.

The driller's log of the well, with depths converted from feet to meters and gallons per minute to litres per second, is given below:

DEPTH (Meters)			LITHOLOGY	FLOW (l/s)
0	-	3.65	sand and gravel overburden	
3.65	-	6.1	till	
6.1	-	7.6	rock soft	
7.6	-	15.2	rock hard	
15.2	-	16.8	rock medium	
16.8	-	24.4	rock hard and soft	
24.4	-	25	rock soft	0.03
25	-	30.5	rock medium	
30.5	-	38.1	rock medium to soft	0.57
38.1	-	43.6	broken layers	0.945

150 mm diameter casing set to 8.23 meters

At the completion of drilling, the hole was developed and blown clean with the compressed air on the drill rig.

4.0 TESTING

A submersible test pump was set in the well with pump suction at a depth of 38 meters. The pumping of the well started on June 7, 1983 at 0930 hours. Before the start of the test, the static water level was measured to be at a depth of 13.92 meters. The well was pumped at a rate of 0.91 l/s for a period of 4400 minutes. At the end of the test period, the pumping level in the well had declined to a depth of 28.975 meters. Recovery readings were taken for 100 minutes after pumping stopped. Water level measurements were made with an electric sounder and tape at time intervals indicated in Section 3.5.1 of the Criteria described above. Discharge rates were obtained by measuring the length of time it took to fill a 22.7 litre (5-gallon) bucket.

5.0 HYDROGEOLOGY

5.1 Geology

Existing geological maps, field observations and examination of drill cuttings around the subject well indicate:

5.1.1 Bedrock is at or close to ground surface in the area of the new well.

5.1.2 Bedrock is composed of schist.

5.1.3 A major northeast-southwest trending fault zone cuts along the northwest face of Vedder Mountain.

5.2 Hydrology

5.2.1 Recharge - The fault zone described in 5.1.3 above with its attendant subsidiary faults and fractures, will form the major recharge area for the lower part of the northwest facing flank of Vedder Mountain. The surface trace of this zone is at an elevation of 600 meters A.S.L. above the subject well. This is above any possible source of pollution or contamination.

5.2.2 Fracture Zones - The main water-bearing fracture zones in the well are reported to lie below a depth of 38 meters

5.2.3 Protection - The presence of the glacial till cap and 18.3 meters of rock above the water-bearing fractures in the well, will protect the well water from contamination by surface or near surface waters.

5.2.4 Analyses - The drawdown water level data were used to calculate a transmissivity value of 4.3×10^{-4} m^2/sec or 3.7 m^2/day (300 US gpd/ft). This is a reasonable transmissivity value for water-bearing fractured bedrock.

If one uses this value of transmissivity, an assumed value of 1×10^{-5} for a coefficient of storage, and a continuous pumping rate of 0.31 l/sec (5 US gpm), the water level in the well can be calculated to be at a depth of 29 meters after 200 days of no recharge or drought. Therefore, under these stringent assumptions, the pumping level in the well will still be above the top of the main fracture zone which lies at a depth of 38 meters.

If one extrapolates the last leg of the drawdown curve altered from the test rate of 0.91 l/sec to the rate used in the calculations of 0.31 l/sec, the water level in the well should be at a depth of 31 meters which is reasonably close to the calculated depth of 29 meters. It would take approximately 90 years for the pumping level to reach the top of the groundwater-bearing zone at a depth of 38 meters based upon a continued extrapolation of the last leg of the curve.

If one takes one-half of the total available drawdown of 24 meters (38-14) or 12 meters and a rule-of-thumb of 100th of the transmissivity in m^2/day for the specific capacity of the well in l/sec/meter of drawdown, the safe

productive potential of the well can be calculated as

12 x (3.7/100) = 0.44 l/sec (7 US gpm)

Therefore, using a safety factor of 100% (½ available drawdown), the safe productive potential of this well should be 0.44 l/sec (7 US gpm).

A conservative rating would give this well a safe productive potential of 0.31 l/sec.

6.0 SUPPLY - STORAGE

6.1 Supply - Section 4.1 of the Abbotsford Criteria states that the water source, in this case the well, should supply the peak day requirement of 6.6m^3 or 0.076 l/sec (1.2 US gpm) per parcel or lot. Therefore, the three lots in this proposed subdivision will require a water source capable of delivering 19.8 m^3 per day or 0.23 l/sec (3.6 US gpm).

6.2 Storage - Section 4.2 of the Abbotsford Criteria states that the storage should require the peak day demand, minus the source flow, times 18 in metric units and 300 in Imperial units.
Storage required for the proposed subdivision will be:

(6.6 x 3) - (0.31 x 18) equals 14.22 m^3 or
approximately 3000 Imperial gallons

7.0 PUMP

It is recommended that a submersible pump be set in this well. It should have the following characteristics:

7.1 Maximum diameter of the pump and motor assembly (plus electrical wire) should be less than 140 mm (5.5-inches).

7.2 Bottom of motor should be set at an approximate depth of 38 meters.

7.3 Discharge 0.31 l/sec (5 US gpm).

7.4 Total Dynamic Head - 35 meters from well plus sufficient head to fill the reservoir to its top. This should be an additional 30 meters.

7.5 The pump must not vibrate or rawhide (starting and stopping at short intervals) the well, nor should water be allowed to backwash into the well.

7.6 A sanitary well seal should cap the well.

8.0 CHEMICAL ANALYSIS

Near the end of the pumping period, water samples were collected for chemical and bacteria analysis. These samples were forwarded to ASL (Analytical Service Laboratories Ltd.) of Vancouver. The samples were labelled H. Darbyshire, BEAL, June 20, 1983. The analyses and remarks are enclosed. You will note that the water is characterized as moderate with respect to dissolved mineralization, and meets Canadian drinking water guidelines for all parameters analyzed.

The analysis for the Coliform Group Bacteria reports less than two per 100 ml for both total and fecal coliform. This analysis indicates that fecal coliforms are not present in the water.

A statement from the District Medical Health Officer regarding the potability of this water is required by the Abbotsford Criteria.

9.0 CONCLUSIONS

Based upon presently available data, the safe productive potential of the new well is judged to be 0.31 l/sec. This is one-third of the pump test rate and one and one-third greater than the requirements set out in the Abbotsford Criteria.

ASL analytical service laboratories ltd.
1650 pandora st · vancouver, b.c. · V5L 1L6
(604) 253-4188

Report On: Water Analysis

File #: 337A

Reported To: Brown Erdman & Associates
1401 Bewicke Ave.
North Vancouver, B.C.
V7M 3C7

Date: June 29, 1983

We have analysed the water samples submitted on June 20, 1983, and report as follows.

SAMPLE INFORMATION

The samples were submitted in proper laboratory containers labelled:

H. DARBYSHIRE BEAL, JUNE 20, 1983

METHOD OF ANALYSIS

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

RESULTS OF ANALYSIS

See attached table.

REMARKS

The waters as represented by the samples submitted can be characterized as moderate with respect to dissolved mineralization.

The water sample met Canadian drinking water guidelines for all parameters analysed.

ASL ANALYTICAL SERVICE LABORATORIES LTD.

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

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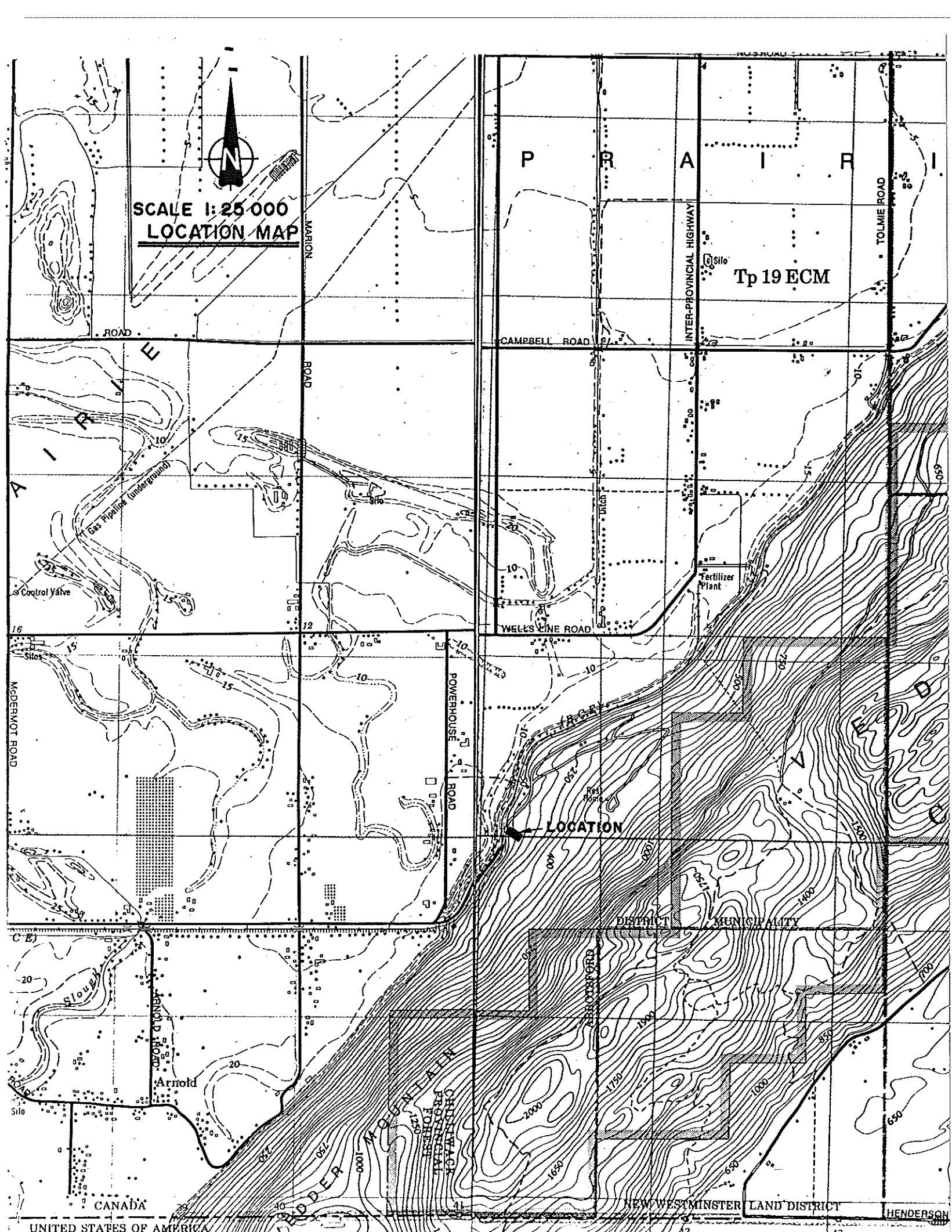
ASL

RESULTS OF ANALYSIS

PARAMETER	
Physical Parameters	
pH	8.60
Specific Conductance (umhos/cm)	140.
Color (CU)	L5
Turbidity (JTU)	L1.
Dissolved Solids (mg/L)	130.
Total Hardness $CaCO_3$ (mg/L)	29.2
Dissolved Anions (mg/L)	
Bicarbonate HCO_3	57.2
Carbonate CO_3	7.5
Fluoride F	0.065
Nitrate + Nitrite N	0.070
Dissolved Metals (mg/L)	
Calcium Ca	6.88
Magnesium Mg	3.12
Sodium Na	17.2
Iron Fe	L0.03
Manganese Mn	L0.001
Total Metals (mg/L)	
Iron Fe	L0.03
Manganese Mn	L0.001
Coliform Group Bacteria (MPN/100 ml)	
Total	L2.0
Fecal	L2.0

L = less than


SCALE 1:25 000
LOCATION MAP
N
MARION ROAD
P R A I R I E
INTER-PROVINCIAL HIGHWAY
TOLMIE ROAD
Silo
Tp 19 ECM
CAMPBELL ROAD
Gas Pipeline (underground)
Ditch
Control Valve
Fertilizer Plant
WELLS LINE ROAD
Silos
McDERMOT ROAD
POWERHOUSE ROAD
Rest Home
LOCATION
DISTRICT MUNICIPALITY
Slough
ARNOLD ROAD
Arnold
Silo
CANADA
UNITED STATES OF AMERICA
NEW WESTMINSTER LAND DISTRICT
HENDERSON

FILE

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BROWN, ERDMAN & ASSOCIATES LTD.
NORTH VANCOUVER, BRITISH COLUMBIA

WELL H.. DARBYSHIRE

PROJECT Subdivision 3 Lots

17 06 83
DAY MO YR

TIME	ELAPSED TIME MINUTES	DEPTH TO WATER ☐ FEET ☒ METERS	DRAWDOWN ☐ FEET ☒ METERS	RATE ☐ USGPM ☐ IGPM ☒ LPS			REMARKS
09:25	0	13.92	0				S.W.L.
09:30	0	-	-				Mp top of casing
09:30:30	.5	14.85	0.93				
09:31	1	15.31	1.39				
09:31:30	1.5	15.45	1.53				
09:32	2	15.97	2.05				
09:32:50	2.5	16.205	2.285				
09:33	3	16.375	2.455				
09:33:50	3.5	16.55	2.63				
09:34	4	16.65	2.73				
09:34:50	4.5	16.805	2.885				
09:35	5	16.915	2.995	0.91			
09:36	6	17.12	3.20				
09:37	7	17.265	3.345				
09:38	8	17.435	3.515				
09:39	9	17.555	3.635				
09:40	10	17.685	3.765				
09:42	12	17.935	4.015				
09:44	14	18.16	4.24				
09:46	16	18.335	4.415				
09:48	18	18.525	4.605	0.91			
09:50	20	18.68	4.76				
09:55	25	19.05	5.13				
10:00	30	19.43	5.51				
10:05	35	19.56	5.64				
10:10	40	19.80	5.88				H_2O Sample
10:15	45	20.00	6.08				
10:20	50	20.12	6.20	0.91			
10:30	60	20.515	6.595				
10:40	70	10.75	6.83				
10:50	80	20.95	7.03				
11:00	90	21.17	7.25				
11:10	100	21.36	7.44	0.91			
12:00	150	22.13	8.21				

BROWN, ERDMAN & ASSOCIATES LTD.
NORTH VANCOUVER, BRITISH COLUMBIA

WELL H. DARBYSHIRE
PROJECT Subdivision 3 Lots

17 06 83
DAY MO YR

TIME	ELAPSED TIME MINUTES	DEPTH TO WATER ☐ FEET ■ METERS	DRAWDOWN ☐ FEET ■ METERS	RATE ☐ USGPM ☐ IGPM ■ LPS			REMARKS
12:50	200	22.61	8.69				
13:40	250	22.85	8.93	0.91			
14:30	300	23.05	9.13				
15:20	350	23.19	9.27				
16:10	400	23.33	9.41	0.91			
17:00	450	23.44	9.52				
17:50	500	23.53	9.61				
19:30	600	23.68	9.76	0.91			
21:10	700	23.93	10.01				
22:50	800	24.13	10.21				
00:30	900	24.30	10.38				
02:10	1000	24.54	10.62				
03:50	1100	24.71	10.79				
05:30	1200	24.89	10.97				
07:10	1300	25.07	11.15	0.91			
08:50	1400	25.28	11.36				
10:30	1500	25.48	11.56	0.91			
12:10	1600	25.63	11.71				
13:50	1700	25.81	11.89				
15:30	1800	25.99	12.07				
17:10	1900	26.12	12.20	0.91			
18:50	2000	26.32	12.40				
20:30	2100	26.48	12.56	0.91			
22:10	2200	26.58	12.66				
23:50	2300	26.72	12.80				
01:30	2400	26.82	12.90				
03:10	2500	26.96	13.04				
04:50	2600	27.10	13.18	0.91			
06:30	2700	27.20	13.28				
08:10	2800	27.33	13.41	0.91			
09:50	2900	27.49	13.57				
11:30	3000	27.60	13.68				
13:10	3100	27.71	13.79	0.91			
14:50	3200	27.89	13.97				

BROWN, ERDMAN & ASSOCIATES LTD.
NORTH VANCOUVER, BRITISH COLUMBIA

WELL H. DARBYSHIRE
PROJECT Subdivision 3 Lots

17 06 83
DAY MO YR

TIME	ELAPSED TIME MINUTES	DEPTH TO WATER ☐ FEET ☒ METERS	DRAWDOWN ☐ FEET ☒ METERS	RATE ☐ USGPM ☐ IGPM ☒ LPS			REMARKS
16:30	3300	27.935	14.015	0.91			
18:10	3400	28.055	14.135				
19:50	3500	28.17	14.25	0.91			
21:30	3600	28.28	14.36				
23:10	3700	28.39	14.47				
00:50	3800	28.49	14.57				
02:30	3900	28.59	14.67				
04:10	4000	28.685	14.765	0.91			
05:50	4100	28.76	14.84				
07:30	4200	28.805	14.885	0.91			
09:10	4300	28.91	14.99				H_20 Sample
10:50	4400	28.975	15.055	0.91			Pump off

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BROWN, ERDMAN & ASSOCIATES LTD.
NORTH VANCOUVER, BRITISH COLUMBIA

WELL H. DARBYSHIRE
PROJECT RECOVERY

DAY MO YR

TIME	ELAPSED TIME MINUTES	DEPTH TO WATER ☐ FEET ☒ METERS	DRAWDOWN ☐ FEET ☒ METERS	RATE ☐ USGPM ☐ IGPM ☐ LPS	T/T'		REMARKS
10:50:30	.5	27.34	13.42		8801		
10:51	1.	26.59	12.67		4401		
10:51:30	1.5	26.36	12.44		2934		
10:52	2	26.17	12.25		2201		
10:52:30	2.5	26.05	12.13		1761		
10:53	3	25.965	12.045		1468		
10:53:30	3.5	25.875	11.955		1258		
10:54	4	25.825	11.905		1101		
10:54:30	4.5	25.795	11.875		979		
10:55	5	25.76	11.84		881		
10:56	6	25.71	11.79		734		
10:57	7	25.665	11.745		630		
10:58	8	25.64	11.72		551		
10:59	9	25.61	11.69		490		
11:00	10	25.585	11.665		441		
11:02	12	25.535	11.615		368		
11:04	14	25.485	11.565		315		
11:06	16	25.445	11.525		276		
11:08	18	25.41	11.49		245		
11:10	20	25.365	11.445		221		
11:15	25	25.29	11.37		177		
11:20	30	25.215	11.295		148		
11:25	35	25.16	11.24		126		
11:30	40	25.065	11.145		110		
11:35	45	25.02	11.10		99		
11:40	50	24.975	11.055		89		
11:45	55	24.92	11.00		81		
11:50	60	24.87	10.95		74		
11:55	65	24.82	10.90		68		
12:00	70	24.78	10.86		64		
12:10	80	24.69	10.77		56		
12:20	90	24.60	10.69		50		
12:30	100	24.52	10.62		45		
08:45	1315	20.90	6.98		4.3		