

Agrichem Analytical

Drinking Water Report

409 Stewart Rd
Salt Spring Island, BC
V8K 1Y6

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Streamline Plumbing
304 Eagleridge well 81240

current treatment
unknown

sample 83809
date received 09-Dec-14
time/temperature 12:00 13 °C
date of report 17-Dec-14
sampled by client

Potable Water Quality Standards

Health Canada (2008) Island Trust (2001)

Total Coliforms	3 MPN/100ml
E. coli	0 MPN/100ml
pH	7.58
Conductivity	471 uS/cm
Total Dissolved Solids (TDS)	314 mg/L
Hardness (as CaCO ₃)	148 mg/L
Alkalinity (as CaCO ₃)	172 mg/L
Residual Chlorine	< 0.02 mg/L
Turbidity	0.93 NTU
Fluoride (F)	0.14 mg/L
Chloride	8.41 mg/L
Nitrate (N)	< 0.01 mg/L
Nitrite (N)	< 0.01 mg/L
Phosphate (P)	< 0.02 mg/L
Sulphate (S)	4.59 mg/L
Sodium (Na)	36 mg/L
Potassium (K)	0.2 mg/L
Magnesium (Mg)	6.5 mg/L
Calcium (Ca)	48.4 mg/L
Iron (Fe)	0.47 mg/L
Copper (Cu)	< 0.01 mg/L
Manganese (Mn)	0.35 mg/L
Zinc (Zn)	< 0.01 mg/L
Arsenic (As)	< 1 ug/l
Lead (Pb)	< 2 ug/L

0	0
0	0
6.5 to 8.5 *	6.5 to 8.5
no limit set	
500*	500
80-100	80-100
no limit set	
	0
****	1
1.5 **	1.5
250 *	250
10 **	10
3.2 **	
no limit set	
500 *	500
200 ***	200
no limit set	
500 *	
no limit set	
0.3 *	0.3
1 *	
0.05 *	0.05
5 *	
10**	10
10**	

< is "less than" > is "greater than"

* aesthetic - no health risk

** maximum

*** 20 mg/L for restricted diets

**** surface water or surface influenced groundwater (drilled well) source 1 NTU **

secure groundwater (drilled well) source 5 NTU *

the presence of Total Coliform bacteria indicates surface influenced water source

For the Total Coliforms and E. coli method, 0 is UNDETECTED and is technically < 1 MPN/100ml

This water sample meets the Health Canada Guidelines for Potability for all parameters tested except for Total Coliforms. The following parameters have not met the Aesthetic Objectives: hardness, iron and manganese - these are not Health concerns and may only contribute to an undesirable smell, taste or color or may cause scale buildup on appliances.

metals and minerals are digested as per APHA 3030E2
Aesthetic Objective - values pose no health risk but may affect the taste, color or smell or cause scaling

John Harris BSc



December 18, 2014

LHC Project File: 1429

Marianne Bowyer-Smyth
304 Eagle Ridge Drive
Saltspring Island, BC
V8K 2L1

Attention: M. Bowyer-Smith

Re: Certification of Groundwater Quantity: Well #81240 - 304 Eagle Ridge Drive, Salt Spring Island, BC

The subject well #81240 was pump tested on December 6, 2014 by Stream Line Plumbing. The purpose of the tests was to confirm that the well would provide a quantity of water not less than 2280 L/day as per the Saltspring Island Local Trust Committee Land Use Bylaw No.355 (2001) for a dwelling unit plus a seasonal cottage. The well meets this criterion.

Confirmation of well water potability to be provided by others.

The reader is cautioned that the above conclusions are provided for the purpose of quick reference only and are not intended under any circumstance as a substitute for reading the entire report.

1.0 WELL LOCATION AND CONSTRUCTION

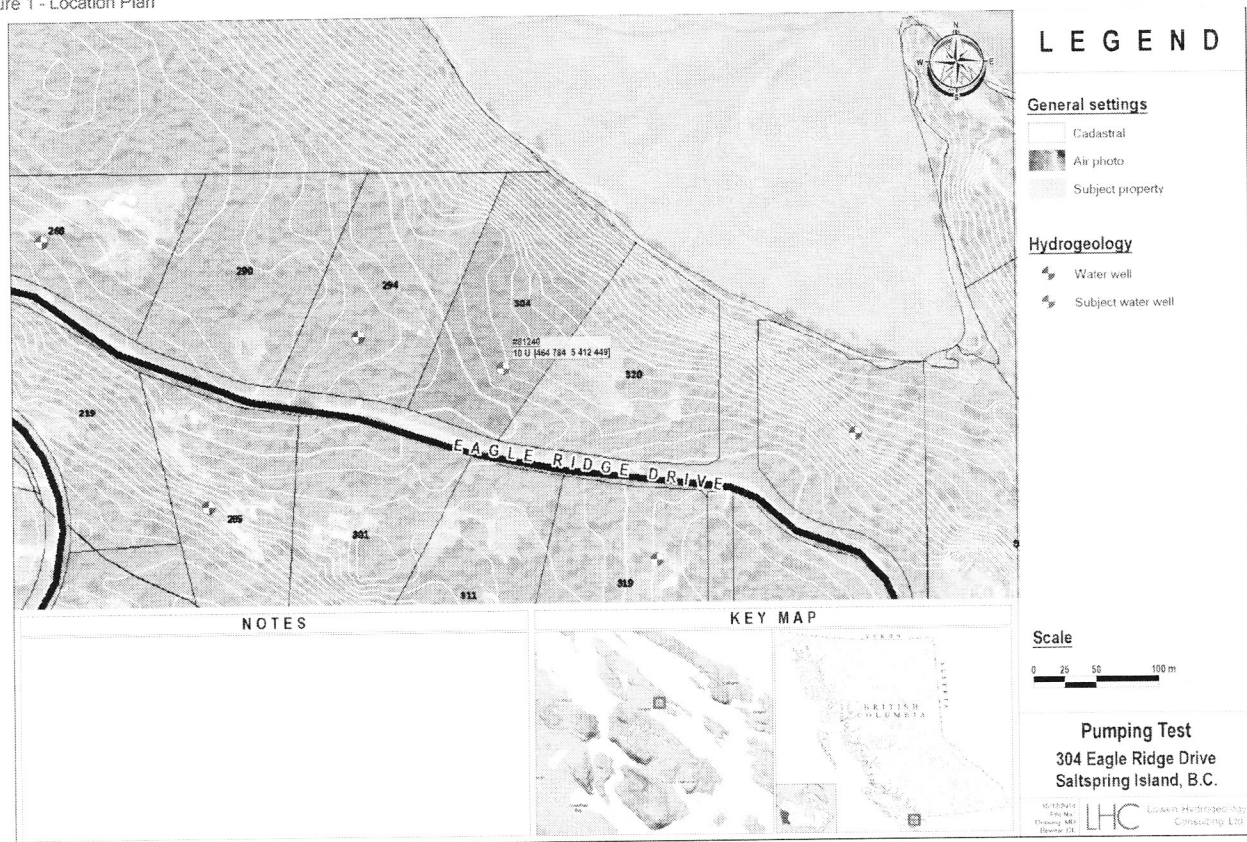
The well was drilled in 1993 by Tri-K Drilling to a depth of 125 ft, however data from the pumping test contractor reported a revised depth of 242 ft. The well was apparently deepened between 1993 and 2014. The well is completed into a fractured sandstone formation and the drillers estimated a yield of 6.0 USgpm at the time of drilling. A detailed well log is displayed in Appendix A.

2.0 HYDROGEOLOGICAL SETTINGS

The well is completed into the bedrock aquifer #721 extending over an area of 47 km². The bedrock is composed of sedimentary rocks of the Nanaimo Group. The aquifer was classified by the Ministry of Environment with low productivity, moderate demand and vulnerability towards contamination from surface.

Most of the recharge in the aquifer is likely due to direct infiltration from precipitation. The recharge varies geographically according to soil coverage and the degree of fracturing in the bedrock at surface. Groundwater flows along fractures, pores and bedding planes. Groundwater flows from high to low elevations and locally follows the ground surface topography.

Figure 1 - Location Plan



3.0 PUMPING TEST DISCUSSION

3.1 Pumping Tests

The subject well was tested for 12 hours at constant rate by Stream Line Plumbing on December 6, 2014. A 2 hour recovery was also recorded. A submersible pump was temporarily installed in the wells and the pump size matched to the anticipated pumping rate of the well. Approximately 24 hours prior to the pumping test, the wells were disinfected with the appropriate amount of chlorine bleach (5.25 percent sodium hypochlorite). Water level measurements were taken at specific intervals using an electric well sounder. A ¾ inch diameter PVC pipe was temporarily installed in the wells to facilitate accurate measurements. The flow rate was checked regularly throughout the pumping test to ensure that the pumping rate was held constant. All drawdown and recovery data and plots are shown in Appendix B.

3.2 Aquifer Parameters

The aquifer transmissivity in the vicinity of the subject well was calculated from the pumping test. The result is as follows:

$$y = 2.5553 \times \ln(x) - 4.7811$$

$$Q = 3.0 \text{ USgpm} = 16.35 \text{ m}^3/\text{d}$$

$$s(10) = 1.10 \text{ m}$$

$$s(100) = 6.99 \text{ m}$$

$$\Delta s = 5.89 \text{ m}$$

$$\Rightarrow T = 0.183 \times 16.35 / 5.89 = 0.51 \text{ m}^2/\text{d}$$

This value is within the expected range for a sandstone/shale bedrock aquifer.

4.0 WELL LONG-TERM CAPACITY

Well long-term capacity corresponds to a safe long-term yield for a well. According to this capacity, the well is able to sustain the determined flow rate continuously using a maximum of 70% of the total available drawdown under the lowest seasonal aquifer static level. The estimated theoretical long-term capacity of the wells has been estimated as follows:

$$\text{Long-term capacity} = \text{Specific capacity @ 100 day} \times \text{safe available drawdown}$$

Where:

- Specific capacity = Pumping rate during the test / Extrapolated drawdown @ 100 days
- Safe available drawdown = 0.7 x Total available drawdown

$$y = 2.5553 \times \ln(x) - 4.7811$$

$$Q = 3.0 \text{ USgpm} = 16.35 \text{ m}^3/\text{d}$$

$$S(100\text{d}) = 25.57 \text{ m}$$

$$SC(100\text{d}) = 16.35 / 25.57 = 0.64 \text{ m}^3/\text{d}/\text{m}$$

$$SAD = 0.7 \times \text{Well Depth} = 34.14 \text{ m}$$

$$\Rightarrow Q = 34.14 \times 0.64 = 21.8 \text{ m}^3/\text{d} = 4.0 \text{ USgpm}$$

The well #81240 meets the Saltspring Island Land Use Bylaw No.355 requirement of 2280 L/day/lot or 0.42 USgpm. This bylaw was adopted in 2001 and has not been amended or suspended since that time with respect to this requirement.

Water level recovery was excellent with 74% of the drawdown recovered after 120 min.

5.0 CONCLUSIONS AND RECOMMENDATIONS

- 5.1 The subject well meets the required criteria of providing at least 2280 L/day/lot or 0.42 USgpm per lot.
- 5.2 Water level recovery was excellent with 74% of the drawdown recovered in 120 min.
- 5.3 Water quality was not included in the terms of reference for this report. The quality in the area is expected to be good, however a water sample should be analysed by a certified laboratory.
- 5.4 Water level should be checked regularly to ensure that the level does not drop below the pump.

6.0 CLOSURE / DISCLAIMER

This report has been prepared in accordance with generally accepted groundwater engineering practices. The opinions expressed herein are considered valid at the time of writing. Changes in site conditions can occur, however, whether due to natural events (e.g. climate change, earthquakes) or to human activities (e.g. recharge area modification, or blasting on this or adjacent properties). These changes may in turn impact well yields and / or water quality. In addition, changes in regulations and standards may occur, whether they result from legislation or the broadening of knowledge. This report is therefore subject to review and revision as changed conditions are identified.

In formulating our analysis, we have relied on information provided by others; well drilling and pumping test contractors and a certified water testing laboratory. The information provided by others is believed to be accurate but cannot be guaranteed by Lowen Hydrogeology Consulting Ltd.

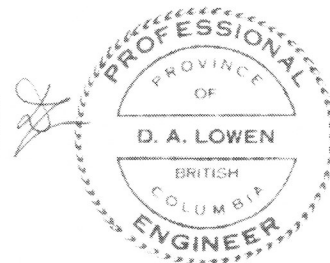
Furthermore, if the recommendations in this report are not implemented, the undersigned assumes no responsibility for any adverse consequences that may occur.

Respectfully submitted,

LOWEN HYDROGEOLOGY CONSULTING LTD.

Dennis Lowen

Dennis A. Lowen, P. Eng. P. Geo.
DL / MD / hr



APPENDIX A

Well Log Record

WELL LOG RECORD
Tag No.81240

PROJECT:	GROUND ELEVATION:
PROJECT No.:	WELL DEPTH: 125 ft
DATE: March 1993	STATIC WATER LEVEL: N/A
WELL TAG No.: 81240	METHOD OF DRILLING:
ADDRESS 304 Eagle Ridge Drive	METHOD OF DEVELOPMENT:
DRILLING CONTRACTOR: Tri-K Drilling	ESTIMATED YIELD: 6.0 USgpm
CLIENT:	LOGGED BY: Tri-K Drilling

Depth (ft bgl.)		Geologic Formation	
From	To	Description	Estimated flow
0	27	Sandstone	Fractures @ 10' & 14'
27	30	Shale	
30	125	Sandstone	4.5 gpm @ 30'
			1.0 gpm @ 90'
			0.5 gpm @ 115'
			Total : 6 gpm
		Note: well has been deepened to 242 ft.	

bgl. = below ground level

Depth (ft bgl.)		Well Construction
From	To	

Notes:

Water:			
Surface seal:	N/A		
GPS Coordinates:	NAD 83 Zone 10 U	UTM Easting	464 784
		UTM Northing	5 412 449

APPENDIX B

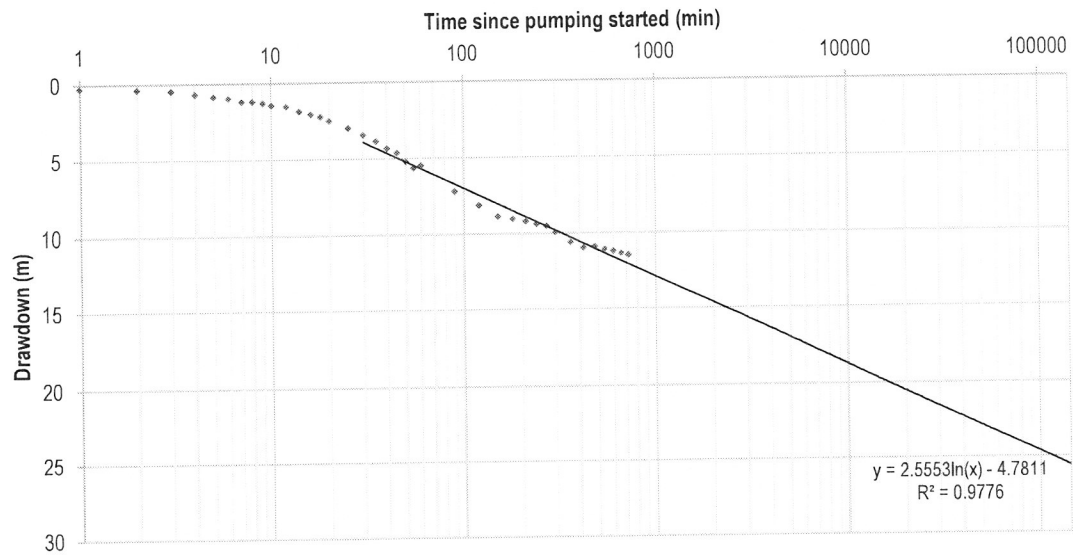
Pumping Test Data

PUMPING TEST DATA – Well ID.81240

PROJECT:	304 Eagle Ridge Dr.	REFERENCE POINT:	N/A
PROJECT No.:	1429	GROUND ELEVATION:	
DATE:	06/12/2014	PUMP INTAKE DEPTH:	
WELL ID. PLATE No.:	81240	STATIC WATER LEVEL:	11.823 m
LOT #:	N/A	END PUMPING LEVEL:	23.235 m
PUMPING CONTRACTOR:	Stream Line Plumbing	END RECOVERY LEVEL:	14.800 m
CLIENT:	M. Bowyer-Smyth	DEPTH TO FRACTURE:	

Time	Elapsed Time (min)	Level (m)	Drawdown (m)	Pumping Rate (USgpm)
7:30 AM	0	11.823	0.000	3.0
	1	12.075	0.252	
	2	12.170	0.347	
	3	12.290	0.467	
	4	12.501	0.678	
	5	12.661	0.838	
	6	12.785	0.962	
	7	12.995	1.172	
	8	13.000	1.177	
	9	13.119	1.296	
	10	13.265	1.442	
	12	13.359	1.536	
	14	13.701	1.878	
	16	13.885	2.062	
	18	14.055	2.232	
	20	14.305	2.482	
	25	14.795	2.972	
	30	15.265	3.442	
	35	15.667	3.844	
	40	16.140	4.317	
	45	16.435	4.612	
	50	17.035	5.212	
	55	17.446	5.623	
	60	17.275	5.452	
	90	19.015	7.192	
	120	19.944	8.121	
	150	20.675	8.852	
	180	20.825	9.002	
	210	21.000	9.177	
	240	21.185	9.362	
	270	21.312	9.489	
	300	21.745	9.922	
	360	22.390	10.567	
	420	22.755	10.932	
	480	22.675	10.852	
	540	22.855	11.032	
	600	22.985	11.162	
	660	23.115	11.292	
	720	23.235	11.412	

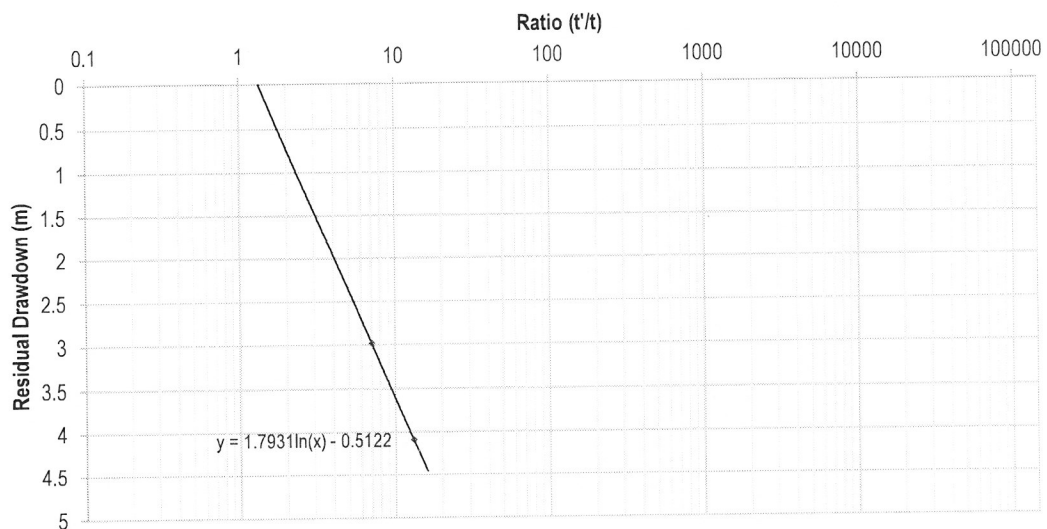
GRAPH 1: Drawdown vs. Time
Well ID.81240



RECOVERY DATA – Well ID.81240

Time t (min)	Elapsed Time t' (min)	Ratio (t/t')	Water Level (m)	Residual Drawdown (m)
780	60	13	15.910	4.087
840	120	7	14.800	2.977

GRAPH 2: Residual drawdown vs. ratio t/t'
Well ID.81240



Recovery: **74 % in 120 min** ⇒ Excellent