Nanoose No. 5

BRITISH COLUMBIA

Well Tag Number 000000075327	Construction Date
Owner: NANAIMO R.D.	
Address: NUTTAL DRIVE	Driller Unknown License Number
Area: NANOOSE BAY	
WELL LOCATION: NANOOSE Land District District Lot 52 Plan 67511 Lot 1 Township Section Range Indian Reserve Meridian Block Quarter Island BCGS Number (NAD 27) 092F040111 Well 2	PRODUCTION DATA AT TIME OF DRILLING: Well Yield 0 Artesian Flow 0 Static Level feet Water Utility Lithology Info Flag Pump Test Info Flag File Info Flag Sieve Info Flag Screen Info Flag Water Chemistry Info Flag Field Chemistry Info Flag Site Info (SEAM) Other Info Flag
Well Use Community Water Supply Construction Method Drilled Diameter 0.0 inches Well Depth 0.0 feet Elevation 0 Bedrock Depth feet Screen from 0 to 0 feet Slot Size 1 0 Slot Size 2 0 Slot Size 3 0 Slot Size 4 0	

GENERAL REMARKS:
WELL PLATE I.D. NUMBER IS 397

no rows selected

Date entered to WELL 19990512

WTN 75327
75328

Nanoose 5+6.

92F040111 - 2

LEVELTON
Engineering Solutions

1.0 INTRODUCTION

Levelton Consultants Ltd. (Levelton) was retained by the Regional District of Nanaimo (RDN) to conduct a hydrogeological assessment and rate the capacity of the Tomei Well #2 (Nanoose #6). The well has been used by the RDN since June of 2002 under a temporary license to supply water to the Nanoose Bay Water District No. BL482.

The purpose of the project was to assess pertinent background information and pumping test results to evaluate the capacity of the Tomei Well #2 in order to obtain permanent well licensing approval from the Vancouver Island Health Authority (VIHA). This report presents the results of our review of background information provided by the RDN and other sources, pumping test data completed on the Tomei Well #2 and other information as required by the VIHA.

1.1 BACKGROUND

The Tomei Well #2 was installed in 1996 by Fyfe's Well Drilling and Pump Co. Ltd. (Fyfe's) for Nick Tomei and Tony Smith as a monitor well to assess the Tomei Well #1 (Nanoose #5) supply for the Dorcas Point Subdivision (Figure 1). The Tomei Well #1 was tested in 1996 by Davey Holdings Ltd. at which time it was determined that the two wells were installed in different aquifers and were not connected. The RDN took over control of the wells to supply the Nanoose Bay Water District in 2001and only used the Tomei Well #1 until it appeared that this well was pumping saltwater. In 2002 the RDN started using the Tomei Well #2 and discontinued use of the Tomei Well #1.

The wells are located on Nuttal Drive in Nanoose near Nuttal Bay (Figure 2) and are approximately 250m apart. The Tomei Well #1 is designated N5 and is approximately 130m deep with a reported static water level of 12.2m below top of casing. The Tomei Well #2 is designated N6 and is approximately 107m deep with a reported flowing volume of 10 igpm. The ground surface at Tomei Well #2 is also approximately 10m higher in elevation than the ground surface at Tomei Well #1. The static levels would suggest that these wells are not connected and therefore not completed in the same aquifer (fracture zone).

An 80 igpm submersible pump was installed in the Tomei Well #2 by Fyfe's for the RDN to supply water to the Nanoose Water District. The RDN received a temporary water use license for the well in June 2002 and began pumping the well at approximately 40 igpm. Water quality analyses, production rates and water levels were recorded by the RDN, and are presented in Appendix 2 of this report.

1.2 SCOPE OF WORK

This project consisted of the following scope of work:

- review and assessment of pertinent background information;
- 100 minute step drawdown test;
- assessment of a 73.5 hour pumping test and subsequent 42 hour recovery test;
- assessment of a 24 hour pumping test and subsequent 74.5 hour recovery test;
- assessment of water quality analyses at the end of the pumping test to compare to the initial water quality analyses;
- data evaluation and assessment of the capacity of the well; and,
- preparation of this report for submission to the RDN.

2.0 BACKGROUND INFORMATION REVIEW

2.1 TOMEI WELL #2 CONSTRUCTION DETAILS

According to Fyfe's drill log and well completion data, the Tomei Well #2 is a 150mm diameter open hole to 107m below ground, which is approximately 85m below sea level. No screen was installed and a 150mm diameter steel surface casing was installed to 5.2m below ground. Bedrock was encountered at 4.0m below ground. Groundwater is produced from fractures in the bedrock from approximately 30m to 100m below ground with the majority of the groundwater produced from the 31m level (25 igpm) with an additional 12 igpm from fractures at 77m, 83m and 100m below ground. The static water level in the well was not reported, although, the well was reported to be flowing at 10 igpm. The estimated yield was reported to be 37.5 igpm.

The lithology of the well is basically sand and gravel from surface to 4m below grade followed by soft, gray argillite bedrock to 61m below grade and medium argillite bedrock to the final depth of drilling of 107m below grade.

A copy of the well report is included in Appendix 2.

2.2 SUMMARY OF DAVEY HOLDINGS LTD. REPORT

According to the Davey Holdings Ltd. report "Geology & Hydrogeology of Drill Hole #1, Dorcas Point Subdivision, Nanoose Bay, BC, February 20, 1996" the Tomei Wells are completed in fractures within Argillite bedrock with a nearly vertical, 80° dip. The wells are approximately 275m apart and not hydraulically connected. No drawdown was recorded in the Tomei Well #2 or any other wells in the vicinity during the pumping test conducted on the Tomei Well #1. The Tomei Well #1 was subsequently rated to be able to produce 50usgpm. The Tomei Well #2 was not pump tested, although, was estimated that it could potentially produce 100Usgpm (83.3 igpm).

Nanoose 5 + 6.

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Tat Water System and Well Details

Well/Water System	Date Drilled	Well Active/Inactive	Water Level on Drilling Date (m bgs)	Current Water Level (m bgs)	Completed Well Depth (m bgs)	Reported Well Capacity on Drilling Date (Usgpm)	Current Average Pumping Rate (Usgpm)
SURFSIDE							
Well No.1	early 1970s	A	1.8	2.4 - 3.1	9.4	60	11
Well No.2	1998	A	3.1	-	9.8	60	9
FRENCH CREEK							
Well No. 1	1972	I	13.4	21.7 - 26.6	43.3	60	0
Well No. 2	1979	A	17.7	27.1 - 31.0	47.5	100	77
Well No. 4	1979	A	17.1	24.6 - 30.5	53.3	135	82
Well No. 5	1988	A	23.1	26.6 - 31.6	72.6	201	140
Well No. 6	1988	A	-	27.8 - 32.3	64.0	134	127
Well No. 7	1992	A	-	22.8 - 26.1	47.6	78	77
Well No. 8	1992	I	-	-	-	-	0
SAN PAREIL							
Well No. 1	1974	A	-	2.1 - 2.3	4.4	135	92
Well No. 2	1974	A	2.3	1.9 - 2.1	5.5	60	55
Well No. 3	2002	A	2.1	-	7.0	50	77
ENGLISHMAN RIVER							
Well No. 1	2003	I	4.3	-	52.4	-	0
Well No. 2	2003	A	3.7	1.8 - 2.5	29.0	96	34
Well No. 3	2003	A	3.5	1.3 - 1.8	32.0	96	78
Well No. 4	2003	I	13.7	-	30.0	25	0
MADRONA							
Well No. 1	prior to 1978	I	-	-	-	-	0
Well No. 2	1978	I	-	-	-	-	0
Well No. 4	1986	A	20.8	26.7 - 31.4	52.1	30-48	21
WALL BEACH- no wells							
DRIFTWOOD- no wells							
NANOOSE							
Well No. 1	1978	A	28.3	36.5 - 37.2	68.9	180	69
Well No. 2	1978	A	32.0	41.1 - 42.3	53.3	305	122
Well No. 3	1980	A	35.4	43.8 - 44.0	52.7	200	61
Well No. 4	1980	A	36.9	40.4 - 44.8	59.1	126	78
Well No. 5	1996	I	12.2	-	130.0	50	0
Well No. 6	1996	A	0 (artesian)	0 (artesian)	107.0	45	30
FAIRWINDS							
Well No. 1	1988	A	38.4	42.1 - 43.9	69.8	250	110
Well No. 2	1988	A	46.9	46.3 - 50.3	75.3	135-215	96
Well No. 3	1990	A	53.6	53.9 - 55.1	72.2	80	48
WEST BAY							
Well No. 1	1981	I	36.6	-	61.0	40	0
Well No. 3	1982	A	39.6	45.8 - 48.9	75.6	208	223
ARBUTUS PARK							
Well No. 1	1980	A	12.2	-	86.9	96	63
PYLADES/DECOURCY							
Well No. 1	1992	A	29.0	29.5 - 36.5	61.0	30	5

Notes: 1) A "-" (dash) indicates no data available.
2) "m bgs" indicates units are given in metres below ground surface.
3) "Usgpm" indicates units are given in United States Gallons Per Minute.
4) The Current Water Level in Column 5 indicates the fluctuation between recent summer and winter readings.

6. The RDN does not have any water intakes from surface water sources. Surface water is, however, purchased from the City of Parksville from May to October each year to replace the RDN's well water supply to the Madrona area during periods of heavy outdoor watering.

7. The average monthly and yearly volume of water distributed in each water system is shown on the attached Data Summary Sheets for 2002, 2003, and 2004. The data will be posted on the RDN website shortly, and will continue to be updated. The volume of surface water purchased from the City of Parksville and distributed to the Madrona area from May to October each year is as follows:

Year	Volume (Units..)	Cost
2001		
2002		
2003		
2004		

8. The storage capacity of each system can be described as follows:

Water System	Reservoir Storage Capacity (Imperial Gallons)	(US Gallons)
SURFSIDE	no reservoir	no reservoir
FRENCH CREEK	140,000	168,000
SAN PAREIL	75,000	90,000
ENGLISHMAN RIVER	140,000	168,000
MADRONA	125,000	150,000
WALL BEACH	supplied by Madrona	supplied by Madrona
DRIFTWOOD	supplied by Beachcomber (Nanoose)	supplied by Beachcomber
NANOOSE Beachcomber Eagle Heights Dolphin	 120,000 75,000 125,000	 144,000 90,000 150,000
FAIRWINDS	300,000	360,000
WEST BAY	supplied by Fairwinds and Arbutus	supplied by Fairwinds and Arbut.
ARBUTUS PARK	125,000	150,000
PYLADES/DECOURCY	32,000	38,500

9. The year each system was built, and major repairs undertaken, can be described as follows:

Water System	Start Up Date	Major Repairs
SURFSIDE	1986	Replaced and upgraded mechanical parts inside pumphouse, replaced pump in Well No.1, repaired broken watermains as required
FRENCH CREEK	1980	Replaced and upgraded mechanical parts inside pumphouse, replaced pumps in Well No.2 and No.5, rehabilitation of Well No.5, improved chlorination system, replaced flushouts and repaired broken watermains as required, completed watermain looping for improved delivery
SAN PAREIL	1974 (Bubbling	Replaced and upgraded mechanical parts inside

Water System	Start Up Date	Major Repairs
	Springs) 1999 (takeover by RDN)	pumphouse, replaced pump in Well No.1, improved chlorination system, replaced flushouts and repaired broken watermains as required, replaced watermain between wells and reservoir, installed water meters, installed security hatches to wells and reservoir, installed security fence, replaced old asbestos-cement watermains with new PVC
ENGLISHMAN RIVER	2003	No major repairs to date
MADRONA	1973	Replaced and upgraded mechanical parts inside pumphouse, replaced pump in Well No.4, replaced flushouts and repaired broken watermains as required, installed security hatches on reservoir, replaced old asbestos-cement watermains with new PVC
WALL BEACH	1992	No major repairs to date
DRIFTWOOD	2001	No major repairs to date
NANOOSE	1980	Replaced and upgraded mechanical parts inside pumphouse, replaced pumps in Wells No.1, No.2, and No.3, rehabilitation of Well No.3, improved chlorination system, replaced flushouts and repaired broken watermains as required, replaced old asbestos-cement watermains with new PVC
FAIRWINDS	1988	Replaced and upgraded mechanical parts inside pumphouses, replaced pumps in Wells No.1 and No.2, improved chlorination system, replaced flushouts and repaired broken watermains as required,
WEST BAY	1980	Demolished and removed the wooden reservoir, replaced pump in Well No.3, replaced flushouts and repaired broken watermains as required
ARBUTUS PARK	1983	Replaced and upgraded mechanical parts inside pumphouse, replaced pump in Well No.1, improved chlorination system, replaced flushouts and repaired broken watermains as required, replaced old asbestos-cement watermains with new PVC
PYLADES/DECOURCY	1998	Replaced and upgraded mechanical parts inside pumphouse, replaced pump in Well No.1, rehabilitation of Well No.1, improved chlorination system

10. Yearly maintenance activities in each water system include fire hydrant maintenance, uni-directional watermain flushing, weekly pumphouse and reservoir checks, chlorine delivery and residual checks, cleaning reservoirs (every other year), well maintenance as required, and brush cutting.

11. No systems draw surface water. As noted in Point 6, the RDN purchases surface water from the City of Parksville from May to October each year to replace the RDN's well water supply to the Madrona area during periods of heavy outdoor watering. The volume of surface water purchased, and the areas to which the surface water is supplied is expected to change (increase) in the coming years. The RDN website will provide more details as they become available (www.rdn.bc.ca).

12. All RDN water systems use chlorine for disinfection of the water supply, except Surfside and Pylades/Decourcy. The temporary storage of drinking water in large

...5...

reservoirs assists in settling out heavier particles, such as oxidized iron and manganese, that are persistent in the well water. No other types of water treatment are used.

13. The system service pressure ranges can be described as follows:

Water System	Minimum Pressure (psi)	Maximum Pressure (psi)
SURFSIDE	35	62
FRENCH CREEK	50	95
SAN PAREIL	55	62
ENGLISHMAN RIVER	32	70
MADRONA	50	70
WALL BEACH	50	65
DRIFTWOOD	40	70
NANOOSE	32	100
FAIRWINDS	50	125
WEST BAY	30	95
ARBUTUS PARK	40	75
PYLADES/DECOURCY	40	125

14. We are not able to provide an accurate statement as to which BC Observation Wells would be representative of the water levels in the RDN's wells.

15. The RDN has a completed Emergency Response Plan (ERP) for the Utilities Department which describes emergency procedures for each water system. The ERP pertains specifically to Contamination of Source, Loss of Source, Flood Conditions, Broken Water Main, Chlorinator Failure, Pump Failure, Power Failure, Backflow or Back Siphonage, Bacteria Count, Reservoir Damage, and Vandalism/Contamination. Specific responses to other adverse situations which may occur including Earthquake, Wildfire/Urban Interface, Tsunami, Dam Breach, Train Derailment, Terrorism, etc. are covered in another RDN document entitled *RDN Emergency Plan- Emergency Coordination Centre/Response Guidelines*. Designated Emergency Response Centres, Coordinators, and Media spokespersons are included in the *RDN Emergency Plan* document.

16. Copy of partnership agreement between RDN, Pville, and TQB. The current operating supervisor is…

17. Dam info: historical water level and discharge data available…

18. Describe RDN's approach to Stormwater management…

19. Describe how the Arrowsmith Society can remain apprised of the RDN's future plans and schedules for delivering bulk water to the Oceanside Communities.

20.

** Include liability statement…
The above information has been provided based on available historic data and/or estimates by experienced staff. Reliance on the above information is the responsibility of the reader.

Please contact our office at 1-877-607-4111 if you have any further questions.

Yours truly,

Mike Donnelly, AScT
Manager of Utilities

Attachments

cc: Deb Churko, AScT, Engineering Technologist

FILED VIVIP67511 D32442 1999-05-12-10.41.46.799030

SUBDIVISION PLAN OF LOT 13, PLAN VIP53395, AND PARCEL B, (DD 1293N) EXCEPT PARTS IN PLANS 21460, 31217, 44310, 48637, AND VIP53395, BOTH IN DISTRICT LOT 52, NANOOSE DISTRICT

B.C.G.S. 92F 040

PLAN VIP67511

Deposited in the Land Title Office at Victoria, B.C., this 21st day of July, 1998.

Registrar

EM68456

Scale 1:1000

0 10 20 40 60 80 100

Legend

- ○ Standard Iron Post set
- ● Standard Iron Post found
- L denotes arc length
- Sq. M. denotes square metres
- All distances shown are in metres
- ⊕ Standard Capped Post found

Bearings are astronomic and derived from Plan VIP53395

Owner : ANTHONY WINSTON PATRICK SMITH

Witness :

Address :

Occupation : BCLS

Owner : NICOLA TOMEI

Witness :

Address :

Occupation : BCLS

The registered owners designated hereon agree that they have entered into a covenant with Her Majesty the Queen in the Right of the Province of British Columbia as represented by the Minister of Environment, Lands and Parks; pursuant to Section 219 of the Land Title Act

Mortgagee : PARKSVILLE AND DISTRICT CREDIT UNION

Authorized Signatory

Authorized Signatory

Witness :

Address : PARKSVILLE, BC

Occupation : ADMIN. ASSISTANT

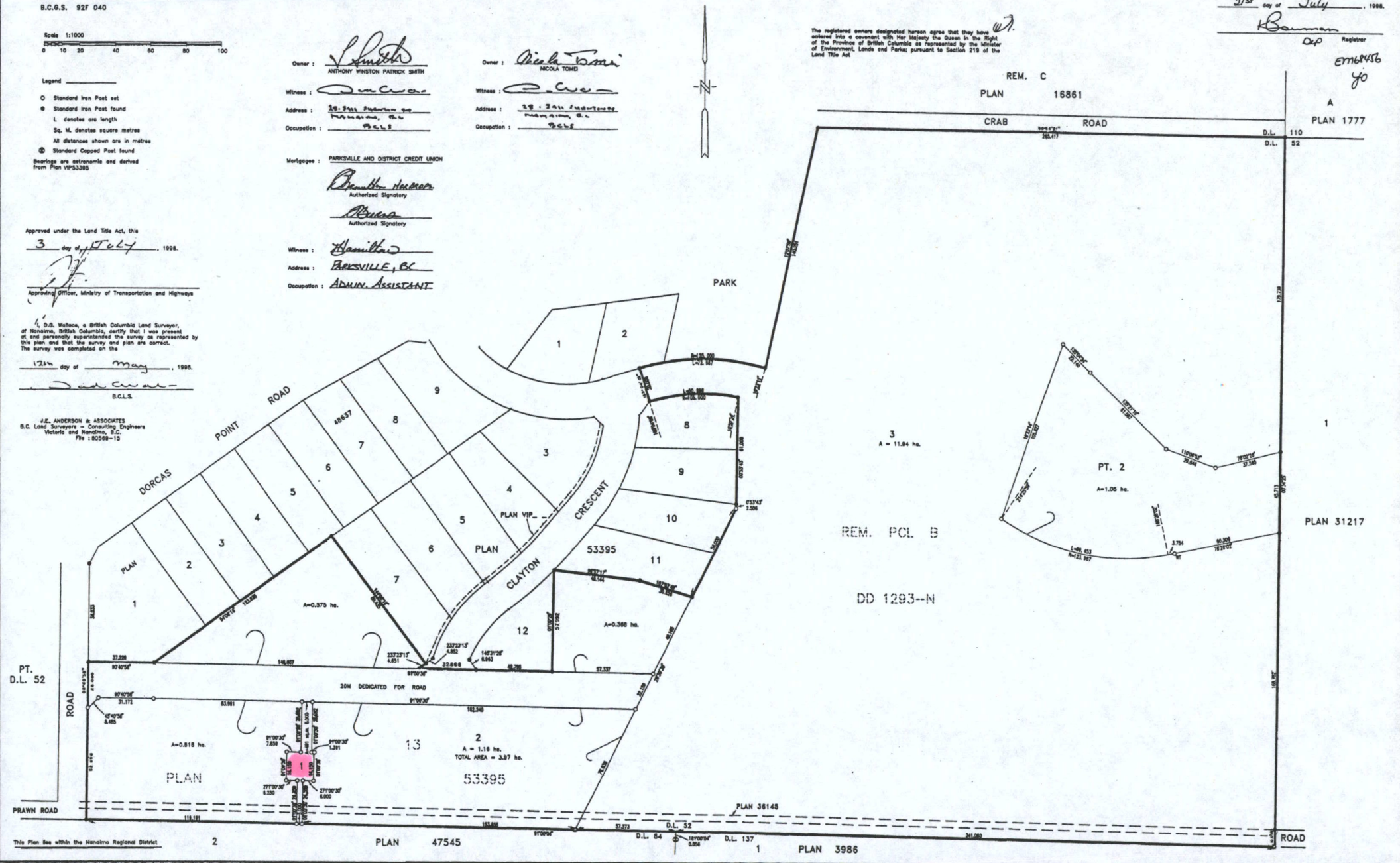
Approved under the Land Title Act, this 3 day of July, 1998.

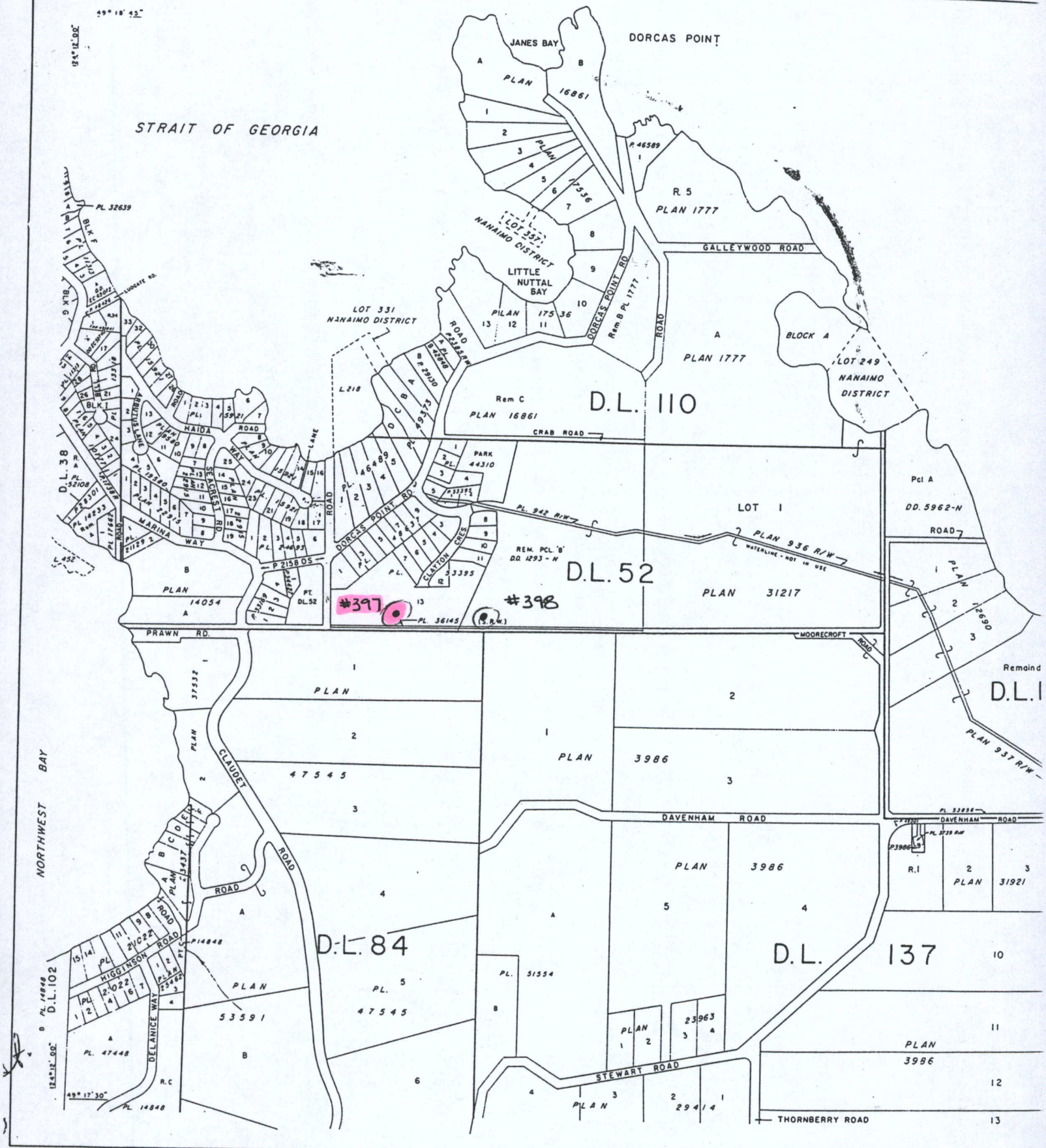
Approving Officer, Ministry of Transportation and Highways

I, D.G. Wallace, a British Columbia Land Surveyor, of Nanaimo, British Columbia, certify that I was present at and personally superintended the survey as represented by this plan and that the survey and plan are correct. The survey was completed on the 12th day of May, 1998.

B.C.L.S.

J.E. ANDERSON & ASSOCIATES
B.C. Land Surveyors - Consulting Engineers
Victoria and Nanaimo, B.C.
File : 80559-15





Derived from interim base map R 92F/8 Ministry of Environment Surveys and Mapping Branch

Revised to: 92-12-31 by: T.S.

Plan no: 53856 date 92-2-9

The Regional District c

(To be completed by person attaching the well plate)

Well identification plate number: 397

Location of where plate is attached: WELL CASING

Unique well tag number (WTN) from the WELL database (get the WTN from the internet): 75327

Legal description of land on which the well is situated:

Lot: _____ Block: _____ Plan: _____ District lot: 52

Section: _____ Township: _____ Range: _____ PID: 24 228 729

Name of well: NANOOSE, DORCAS PT. ESTATES #5

Well owner's name: REGIONAL DISTRICT OF NANAIMO

Well owner's mailing address and phone number: 6300 HAMMOND BAY RD., P.O. BOX 40
LANTZVILLE, B.C., V0R 2H0
250-390-4111

Well Information

Copy of well log attached [check]

Send to: Groundwater Section
Water Management Branch
PO Box 9340 STN PROV GOVT
Victoria, BC V8W 9M1

Confirmation notice: for Ministry use only

Information on the above has been entered on the WELL database [check]

Processed by: JT Date: May 12/99

BCGS MAP 92F.040.1.1.1 WTN 75327 WELL NO. 002

WATER WELL RECORD

MINISTRY OF WATER, LAND AND AIR PROTECTION — VICTORIA, BRITISH COLUMBIA

LEGAL DESCRIPTION: LOT 1 SEC. ____ TP. ____ R. ____ D.L. 52 LAND DISTRICT Nanoose PLAN VIP67511

DESCRIPTIVE LOCATION 2500 Nuttal Dr. LICENCE NO. ____ DATE ____

Z ____ WELL NO. ____

____ E

____ N

Z X Y NO.

NAT. TOPO. SHEET NO. ____

OWNER'S NAME Nanaimo Reg Dist. ADDRESS ____

DRILLER'S NAME Unknown ADDRESS ____ DATE COMPLETED ____

DEPTH ____ ELEVATION OF ____ ☐ ESTIMATED ☐ SURVEYED CASING DIAM. ____ LENGTH ____

METHOD OF CONSTRUCTION ____ CASING DIAM ____ LENGTH ____

SCREEN LOCATION ____ SCREEN ☐ SIZE ____ LENGTH ____ TYPE ____

SANITARY SEAL YES ☐ NO ☐ SCREEN ☐ SIZE ____ LENGTH ____ TYPE ____

PERFORATED CASING ☐ LENGTH ____ PERFORATIONS FROM ____ TO ____

GRAVEL PACK ☐ LENGTH ____ DIAM. ____ SIZE GRAVEL, ETC. ____

DISTANCE TO WATER ____ ☐ ESTIMATED WATER LEVEL

FROM ____ ☐ MEASURED ELEVATION ____ ARTESIAN PRESSURE ____

DATE OF WATER LEVEL MEASUREMENT ____ WATER USE ____

PRODUCTION TEST SUMMARY

DATE ____

TEST BY ____

BAIL TEST ☐ PUMP TEST ☐ DURATION OF TEST ____

RATE ____ DRAWDOWN ____

WATER LEVEL AT COMPLETION OF TEST ____

AVAILABLE DRAWDOWN ____ SPECIFIC CAPACITY ____

PERMEABILITY ____ STORAGE COEFF. ____

TRANSMISSIVITY ____

ESTIMATED WELL YIELD ____

RECOMMENDED PUMPING RATE ____

RECOMMENDED PUMP SETTING ____

CHEMISTRY

TEST BY ____ DATE ____

TOTAL DISSOLVED SOLIDS ____ mg/l TEMPERATURE ____ °C pH ____ SILICA (SiO_2) ____ mg/l

CONDUCTANCE ____ μmhos/cm AT 25°C TOTAL IRON (Fe) ____ mg/l TOTAL HARDNESS ($CaCO_3$) ____ mg/l

TOTAL ALKALINITY ($CaCO_3$) ____ mg/l PHEN. ALKALINITY ($Ca\ CO_3$) ____ mg/l MANGANESE (Mn) ____ mg/l

COLOUR ____ ODOUR ____ TURBIDITY ____

ANIONS	mg/l	epm
CARBONATE (CO_3)		
BICARBONATE (HCO_3)		
SULPHATE (SO_4)		
CHLORIDE (Cl)		
$NO_2 + NO_3$ (NITROGEN)		
* TKN. (NITROGEN)		
PHOSPHORUS (P)		

CATIONS	mg/l	epm
CALCIUM (Ca)		
MAGNESIUM (Mg)		
SODIUM (Na)		
POTASSIUM (K)		
IRON (DISSOLVED)		

* TKN = TOTAL KJELDAHL NITROGEN

NO_2 = NITRITE NO_3 = NITRATE

CHEMISTRY SITE NO. ____

CHEMISTRY FIELD TESTS

TEST BY ____ DATE ____ EQUIPMENT USED ____

LITHOLOGY

FROM	TO	DESCRIPTION
		NB Well No. 5

CONTENTS OF FOLDER

☐ DRILL LOG ☐ PUMP TEST DATA ☐ CHEMICAL ANALYSIS

☐ SIEVE ANALYSIS ☐ GEOPHYSICAL LOGS ☐ REPORT

OTHER ____

SOURCES OF INFORMATION ____

NORTH

WEST

EAST

SOUTH

CARD BY_____ DATE_____

ADDITIONAL DATA ADDED BY_____

REMARKS

Original record missing. Add original to this file when found. ✓

LEGAL CONFIRMED THROUGH LAND TITLE OFFICE 05/12/99

ENV 1995

97941