



**THURBER** ENGINEERING LTD.

September 18, 2013

File: 17-336-1

Regional District of Nanaimo  
6300 Hammond Bay Road  
Nanaimo, BC V9T 6N1

Attention: Mr. Wayne Moorman, P.Eng.

**REVISED GWUDI FOLLOW-UP STUDY  
RDN SAN PAREIL WELL FIELD**

Dear Wayne:

Thurber Engineering Ltd. (Thurber) is pleased to submit this report to the Regional District of Nanaimo (RDN) providing the results of a follow-up 'ground water under direct influence of surface water' (GWUDI) investigation for two existing wells (Well #1 and Well #4) at the San Pareil Well Field in Parksville, BC.

This revised report supersedes the original report dated October 4, 2012. Use of this letter report is subject to our Statement of Limitations and Conditions, which is located following the text of this report.

**1. BACKGROUND**

The San Pareil well field is shown in the attached Figure 1. There are four existing groundwater wells on the subject property, two of which are currently in use as production wells. The two production wells (RDN Well #1 and Well #4) are identified respectively by BC Ministry of Environment (MOE) well identification numbers (WIN) 13713 and 13993. The well field was constructed in 1970 (Wright Parry, 1996) and has been operated by the RDN since 1999 when it was taken over from Bubbling Springs Utilities.

Well #1 was constructed around 1976 and is known to be comprised of a dug well connected to a single, 30 m long, horizontal infiltration gallery (Thurber, 2010). It is unknown who constructed this well. Well #4 was drilled and tested by Fyfe's Well Drilling in 2004 under the direction of Levelton Consultant Ltd. (Levelton, 2005). In 2011, Well #1 was intermittently utilized at a pumping rate of 10.4 L/s (165 USgpm) and Well #4 at a rate of 15.6 L/s (247 USgpm).

A GWUDI investigation was conducted by Thurber in 2010 which resulted in an indeterminate risk status for the subject wells as per the then BC MOE "Draft 5 Guidance Document for Determining Ground Water at Risk of Containing Pathogens Including Ground Water Under Direct Influence of Surface Water" (Kohut, 2009), which has recently been issued in non-draft form (BC MOH, 2012). The initial GWUDI investigation made a number of recommendations for further study. This GWUDI follow-up study addresses the additional monitoring and alterations to the site/wells that has been conducted as per the Thurber (2010) recommendations. It is our understanding that reporting from this study will be submitted to the Vancouver Island Health Authority (VIHA).



## 2. METHODOLOGY

In response to the recommendations made in the original GWUDI investigation, the following works have been completed by the RDN:

- Raw water sampling of Well #1 and Well #4 has been conducted on a monthly basis since June 2011;
- Long-term, continuous water level monitoring of a stilling well connected to the nearby wetlands was initiated in April 2010; and,
- A surface seal was constructed around Well #1 and the casing stickup was extended.

Thurber undertook the following tasks for this GWUDI follow-up investigation:

- Compiled water level monitoring data collected by the RDN from MW1, MW2, Well #4, and the wetlands over approximately the previous 2 years;
- Compiled bacteriological water quality data that has been collected by the RDN since June 2011;
- Undertook collection and analysis of 2 *Cryptosporidium* and *Giardia* filtration samples and 2 samples for particle distribution analysis.
- Liaised with contractors for Well #1 surface sealing; and,
- Estimated groundwater travel times.

## 3. RESULTS

### 3.1 Water Level Monitoring

Three wells (MW1, MW2, Well #4) completed in the shallow sand and gravel aquifer, and a stilling well connected to the nearby wetlands, are being continuously monitored at the San Pareil well field for water level and temperature.

Each of the monitoring wells has a data-logging transducer, capable of measuring temperature and pressure, from which the data has been downloaded monthly since June 2011. Barometric pressure was subtracted from the pressure measured in the wells to obtain water levels for this period of time. During downloading of the data, manual water levels were measured by the RDN in the wells with dataloggers and in Well #1 and Well #2.

Water elevations from April 2010 to March 2012 are compiled in Figure 2. From this figure, it is apparent that groundwater and wetland elevations fluctuated in the wet season in response to precipitation events and were relatively stable in the dry season. High-frequency water level variations on the order of 1 to 1.5 m are evident in Well #4 as a result of pumping. Well #4



pumping also affected the water levels in nearby MW2 which were drawn down on the order of 0.5 m.

Water elevations and trends were similar at Well #1, Well #2, MW1, and the wetlands throughout the monitoring period. Groundwater elevations at Well #4 and MW2 were approximately 0.5 m lower in elevation than at other locations. Similar water elevations and trends between the groundwater and nearby wetlands suggest a direct hydraulic connection between the shallow groundwater and the surface water.

### 3.2 Water Quality Monitoring

Raw water sampling of the production wells at San Pareil has been conducted annually since 2004 at Well #1 and since 2008 at Well #4<sup>1</sup>. Monthly bacteriological sampling of raw water for total coliform and *E. coli* analysis was initiated in June 2011. Since sampling was initiated, there have been no samples from either Well #1 or Well #4 in which *E. coli* has been detected. Total coliforms is regularly detected in both wells with concentrations at Well #1 ranging from <1.0 to >200 (on October 26, 2004) colony forming units (CFU)/100 mL or most probable number (MPN)/100 mL and concentrations at Well #4 ranging from <1 to 6.4 CFU/100 mL or MPN/100mL. According to the Guidelines for Canadian Drinking Water Quality (GCDWQ)<sup>2</sup>, total coliforms are widely distributed in the water and soil of the natural environment. Total coliforms may therefore be widespread throughout the shallow, unconfined aquifer at San Pareil. Laboratory data sheets from monthly bacteriological sampling conducted since June are attached and summarized in Table 1.

Table 1. Summary of Concentrations of Bacteriological Parameters for Well #1 and Well #2 from June 2011 to March 2012

DATE	TIME	WELL #1 (MPN/100mL)		WELL #4 (MPN/100mL)	
		Total coliforms	<i>E.coli</i> .	Total coliforms	<i>E.coli</i> .
June 27/11	09:13	<b><u>2.0</u></b>	<1.0	<1.0	<1.0
Jul 25/11	09:39	<b><u>4.2</u></b>	<1.0	<1.0	<1.0
Aug 29/11	09:30	<b><u>1.0</u></b>	<1.0	<b><u>1.0</u></b>	<1.0
Sept 21/11	09:33	<b><u>3.1</u></b>	<1.0	<1.0	<1.0
Oct 19/11	13:56	<b><u>9.9</u></b>	<1.0	<b><u>1.0</u></b>	<1.0
Nov 21/11	13:28	<b><u>8.7</u></b>	<1.0	<b><u>1.0</u></b>	<1.0
Dec 7/11	11:33	<b><u>19.2</u></b>	<1.0	<b><u>6.4</u></b>	<1.0
Jan 23/12	09:00	<b><u>4.2</u></b>	<1.0	<1.0	<1.0
Feb 29/12	14:20	<1.0	<1.0	<b><u>2.0</u></b>	<1.0
Mar 29/12	09:12	<1.0	<1.0	<b><u>3.1</u></b>	<1.0

Note: bold and underline numbers indicate values exceeding the GCDWQ maximum acceptable concentration of none detectable (<1.0) per 100 mL at the point of consumption.

<sup>1</sup> <http://www.rdn.bc.ca/cms.asp?wpID=900>

<sup>2</sup> <http://www.hc-sc.gc.ca/ewh-semt/water-eau/drink-potab/guide/index-eng.php>



Samples for microscopic particulate analysis (MPA) were obtained from the pumping wells and analyzed by Hyperion Research Ltd. using a combination of the US Environmental Protection Agency (USEPA)'s Consensus Method for Determining Groundwaters Under the Direct Influence of Surface Water (Vasconcelos and Harris, 1992) and USEPA Method 1623 (USEPA, 2005). MPA sampling was conducted in February 2010 as part of the initial GWUDI investigation (Thurber, 2010) and again in July 2011. Sampling was conducted while the wells were pumping at their utilization rates. The July 2011 MPA sampling resulted in a moderate risk of microbiological contamination from surface water based on the rating system of the Consensus Method (risk factors of 17 for Well #1 and 12 for Well #2). No *Cryptosporidium* oocysts or *Giardia* cysts were present in any of the samples tested. Laboratory data sheets from recent MPA sampling are attached.

To assess aquifer filtration, samples were also obtained in July 2011 for particle size distribution analysis. According to the Terms of Reference of the Ontario GWUDI procedure (Ontario MOE, 2001), one line of evidence for demonstrating whether the aquifer is providing effective *in situ* filtration is particle count data showing that the water consistently contains significantly less than 100 particles per mL in the size range 10 microns and greater in size. Unfortunately, the type of particle distribution analysis that was conducted on the San Pareil samples at the University of British Columbia cannot be directly compared to this objective. The UBC results from the water sample collected from Well #4 (attached) indicated that approximately 60% of the particles were above 10 microns in size, although the equivalent concentration in particles per mL is not known. According to the UBC lab, the sample collected from Well #1 can be considered very clean as particle counts were close to those of the background electrolyte which is filtered through 0.45 micron filter paper. The result from Well #1 suggests that aquifer filtration, as demonstrated from the one sampling date at this well, may be effective.

Note that particulate count can change significantly with recharge events in groundwater connected to surface water. Additional particle size distribution samples were not obtained at this time, however, the groundwater quality at San Pareil may be affected by extreme recharge events. This conclusion is supported by the fact that chlorine injection during water treatment sometimes has to be increased during heavy rains, possibly due to an increase in suspended particulate in the water.

### **3.3 Well Closures and Alterations**

A surface seal was constructed by Fyfe Well and Water Services around Well #1 on July 19, 2011. This was done by removing the native material from around the concrete-cased wellhead to a depth and width of approximately 1 m. This space was then backfilled with a bentonite slurry and tamped.

On October 24, 2011, the RDN extended the concrete ring casing stickup of Well #1 by 0.65 m to raise the top above the inferred 200 year flood level. To improve the seal, the joint between the new and old concrete rings was grouted.

On July 16, 2012, Precision Service and Pumps Inc. (Precision) formally closed Well #2 by excavating down and removing the top concrete casing ring and then filling the hole with



alternating layers of bentonite and 20 mm gravel. The 300 mm-diameter observation well next to the production well and the 100 mm-diameter piezometers at the east end of the infiltration gallery were also closed at the same time as Well #2 by backfilling with bentonite. Also on July 16, 2012, Precision extended the steel casing on MW1 by 2 m. The well alteration and closure logs for the work done by Precision are attached.

### 3.4 Travel Time Estimates

According to the GWUDI Guidance Document, where aquifer filtration is adequate, an estimated time of travel that is greater than 100 days from a potential source of pathogens (e.g. surface water) to a well supports the water source being deemed at low risk of containing pathogens from a GWUDI situation.

Using a flow gradient ( $i$ ) of 0.008 (based on the relative difference in water levels between MW2 and MW1), a transmissivity ( $T$ ) of  $1.3 \times 10^{-2} \text{ m}^2/\text{s}$  (Levelton, 2005), an aquifer thickness ( $b$ ) of 5 m, and an effective porosity ( $\theta$ ) of 0.3, the average linear groundwater velocity ( $v$ ) was calculated as follows (Freeze and Cherry, 1979):

$$v = \frac{T i}{b \theta}$$

This resulted in a velocity of approximately 6 m/day. At this velocity, the travel time from the wetland to both Well #1 and Well #4 (both a distance of about 30 m from the wetland) is approximately 5 days. Using the same groundwater velocity, the estimated travel time from the Englishman River to Well #1 (a distance of approximately 60 m) is 10 days and to Well #4 (~90 m away) is 15 days.

## 4. CONCLUSIONS AND RECOMMENDATIONS

The results of groundwater level monitoring confirm that there is a direct hydraulic connection between the aquifer at the San Pareil well field, the nearby wetlands and likely the Englishman River. In addition, total coliform is regularly detected in the raw water samples from Well #1 and Well #4 and the estimated travel time from the nearby wetlands to the wells is considerably less than the 100 days recommended in the GWUDI Guidance Document. Based on these data and the assessment criteria established in the GWUDI Guidance Document, Well #1 and Well #4 are considered 'at risk' of containing pathogens from a GWUDI situation.

To 'ensure the provision of microbiological safe drinking water' we understand that water systems sourcing a surface water supply are subject to the VIHA 4-3-2-1 policy<sup>3</sup>. The groundwater source from the San Pareil well field is presently chlorinated and, based on the small dataset available from MPA and particulate size distribution analysis, there is evidence to show that adequate filtration may be occurring in the aquifer. If this is the case, conditions may currently meet the 4-3-2-1 treatment requirements for surface water. It is our understanding that

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<sup>3</sup> <http://www.health.gov.bc.ca/protect/pdf/surfacewater-treatment-objectives-march-2012.pdf>



this water system has operated for over 40 years with no known issues of bacteria or pathogens at the point of consumption. This would lend support to the effectiveness of *in situ* aquifer filtration combined with reservoir chlorination which is the present treatment regime at San Pareil.

Should the current level of treatment be maintained for water sourced from the San Pareil wells, we recommend the following long-term monitoring activities be implemented (at a minimum):


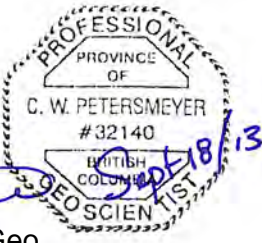
- Continuing water level monitoring in the select wells and the wetlands (reduced from monthly to quarterly manual readings and downloads from dataloggers).
- Continuing monthly raw water sampling in the dry months (June to October) and expanding to bi-monthly (i.e. twice per month) sampling in the wet months (November to May) for bacteriological analyses (*E. coli* and total coliforms).
- Initiating bi-annual (i.e. twice per year) sampling for particulate size distribution analysis and annual MPA on each well on alternating years to confirm adequate filtration is occurring. The annual MPA sample and at least one of the bi-annual particle size distribution samples should be obtained in the wet season, preferably following a heavy rain event.
- Annual review of the sampling data for assessment of aquifer filtration performance.



## CLOSURE

We trust the above provides the information you require at this time. If you have any questions regarding this document, please contact the undersigned at your earliest convenience.

Yours truly,  
Thurber Engineering Ltd.  
Kevin Sterne, P.Eng.  
Review Principal

  
  
Chad Petersmeyer, P. Geo.  
Hydrogeologist

Attachment



## REFERENCES

BC MOH, Guidance Document for Determining Ground Water at Risk of Containing Pathogens (GARP) Including Ground Water Under Direct Influence of Surface Water (GWUDI) Version 1, Health Protection Branch, Population and Public Health Division, Ministry of Health, April, 2012.

Freeze, R. A., and J. A. Cherry, Groundwater, Prentice Hall Inc., New Jersey, 1979.

Kohut A., Draft 5 Guidance Document for Determining Ground Water at Risk of Containing Pathogens Including Ground Water Under Direct Influence of Surface Water, Province of British Columbia, 2009.

Levelton Consultants Ltd., Hydrogeological Assessment of San Pareil Well #2, San Pareil Well field, Parksville, BC, submitted to Regional District of Nanaimo, 2005.

Ontario Ministry of the Environment, Terms of Reference for Hydrogeological Study to Examine Groundwater Sources Potentially Under Direct Influence of Surface Water, October 2001.

Wright Parry, Water System Study Bubbling Springs Utilities Parksville, BC, submitted to Bubbling Springs Utilities, 1996.

Thurber Engineering Ltd., Regional District of Nanaimo San Pareil Wells GWUDI Investigation, submitted to Regional District of Nanaimo, 2010.

United States Environmental Protection Agency, Method 1623: Cryptosporidium and Giardia in water by filtration/IMS/FA, US EPA 815-R-05-002, 2005.

Vasconcelos J. and S. Harris, Consensus Method for Determining Groundwater under the Direct Influence of Surface Water Using Microscopic Particulate Analysis (MPA), US EPA 910/9-92-029, 1992.





## STATEMENT OF LIMITATIONS AND CONDITIONS

### 1. STANDARD OF CARE

This study and Report have been prepared in accordance with generally accepted engineering or environmental consulting practices in this area. No other warranty, expressed or implied, is made.

### 2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report which is of a summary nature and is not intended to stand alone without reference to the instructions given to us by the Client, communications between us and the Client, and to any other reports, writings, proposals or documents prepared by us for the Client relative to the specific site described herein, all of which constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. WE CANNOT BE RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

### 3. BASIS OF REPORT

The Report has been prepared for the specific site, development, design objectives and purposes that were described to us by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the document, subject to the limitations provided herein, are only valid to the extent that this Report expressly addresses proposed development, design objectives and purposes, and then only to the extent there has been no material alteration to or variation from any of the said descriptions provided to us unless we are specifically requested by the Client to review and revise the Report in light of such alteration or variation or to consider such representations, information and instructions.

### 4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT OUR WRITTEN CONSENT AND SUCH USE SHALL BE ON SUCH TERMS AND CONDITIONS AS WE MAY EXPRESSLY APPROVE. The contents of the Report remain our copyright property. The Client may not give, lend or, sell the Report, or otherwise make the Report, or any portion thereof, available to any person without our prior written permission. Any use which a third party makes of the Report, are the sole responsibility of such third parties. Unless expressly permitted by us, no person other than the Client is entitled to rely on this Report. We accept no responsibility whatsoever for damages suffered by any third party resulting from use of the Report without our express written permission.

### 5. INTERPRETATION OF THE REPORT

- a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgmental in nature. Comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel, may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and the Client and all other persons making use of such documents or records with our express written consent should be aware of this risk and this report is delivered on the express condition that such risk is accepted by the Client and such other persons. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. Where special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.
- b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to us. We have relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, we cannot accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other persons providing information relied on by us. We are entitled to rely on such representations, information and instructions and are not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.

(see over . . . .)



## INTERPRETATION OF THE REPORT *(continued . . .)*

- c) Design Services: The Report may form part of the design and construction documents for information purposes even though it may have been issued prior to the final design being completed. We should be retained to review the final design, project plans and documents prior to construction to confirm that they are consistent with the intent of the Report. Any differences that may exist between the report recommendations and the final design detailed in the contract documents should be reported to us immediately so that we can address potential conflicts.
- d) Construction Services: During construction we must be retained to provide field reviews. Field reviews consist of performing sufficient and timely observations of encountered conditions to confirm and document that the site conditions do not materially differ from those interpreted conditions considered in the preparation of the report. Adequate field reviews are necessary for Thurber to provide letters of assurance, in accordance with the requirements of many regulatory authorities.

## **6. RISK LIMITATION**

Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause an accidental release of those substances. In consideration of the provision of the services by us, which are for the Client's benefit, the Client agrees to hold harmless and to indemnify and defend us and our directors, officers, servants, agents, employees, workmen and contractors (hereinafter referred to as the "Company") from and against any and all claims, losses, damages, demands, disputes, liability and legal investigative costs of defence, whether for personal injury including death, or any other loss whatsoever, regardless of any action or omission on the part of the Company, that result from an accidental release of pollutants or hazardous substances occurring as a result of carrying out this Project. This indemnification shall extend to all Claims brought or threatened against the Company under any federal or provincial statute as a result of conducting work on this Project. In addition to the above indemnification, the Client further agrees not to bring any claims against the Company in connection with any of the aforementioned causes.

## **7. SERVICES OF SUBCONSULTANTS AND CONTRACTORS**

The conduct of engineering and environmental studies frequently requires hiring the services of individuals and companies with special expertise and/or services which we do not provide. We may arrange the hiring of these services as a convenience to our Clients. As these services are for the Client's benefit, the Client agrees to hold the Company harmless and to indemnify and defend us from and against all claims arising through such hirings to the extent that the Client would incur had he hired those services directly. This includes responsibility for payment for services rendered and pursuit of damages for errors, omissions or negligence by those parties in carrying out their work. In particular, these conditions apply to the use of drilling, excavation and laboratory testing services.

## **8. CONTROL OF WORK AND JOBSITE SAFETY**

We are responsible only for the activities of our employees on the jobsite. The presence of our personnel on the site shall not be construed in any way to relieve the Client or any contractors on site from their responsibilities for site safety. The Client acknowledges that he, his representatives, contractors or others retain control of the site and that we never occupy a position of control of the site. The Client undertakes to inform us of all hazardous conditions, or other relevant conditions of which the Client is aware. The Client also recognizes that our activities may uncover previously unknown hazardous conditions or materials and that such a discovery may result in the necessity to undertake emergency procedures to protect our employees as well as the public at large and the environment in general. These procedures may well involve additional costs outside of any budgets previously agreed to. The Client agrees to pay us for any expenses incurred as the result of such discoveries and to compensate us through payment of additional fees and expenses for time spent by us to deal with the consequences of such discoveries. The Client also acknowledges that in some cases the discovery of hazardous conditions and materials will require that certain regulatory bodies be informed and the Client agrees that notification to such bodies by us will not be a cause of action or dispute.

## **9. INDEPENDENT JUDGEMENTS OF CLIENT**

The information, interpretations and conclusions in the Report are based on our interpretation of conditions revealed through limited investigation conducted within a defined scope of services. We cannot accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or others who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes but is not limited to decisions made to develop, purchase or sell land.



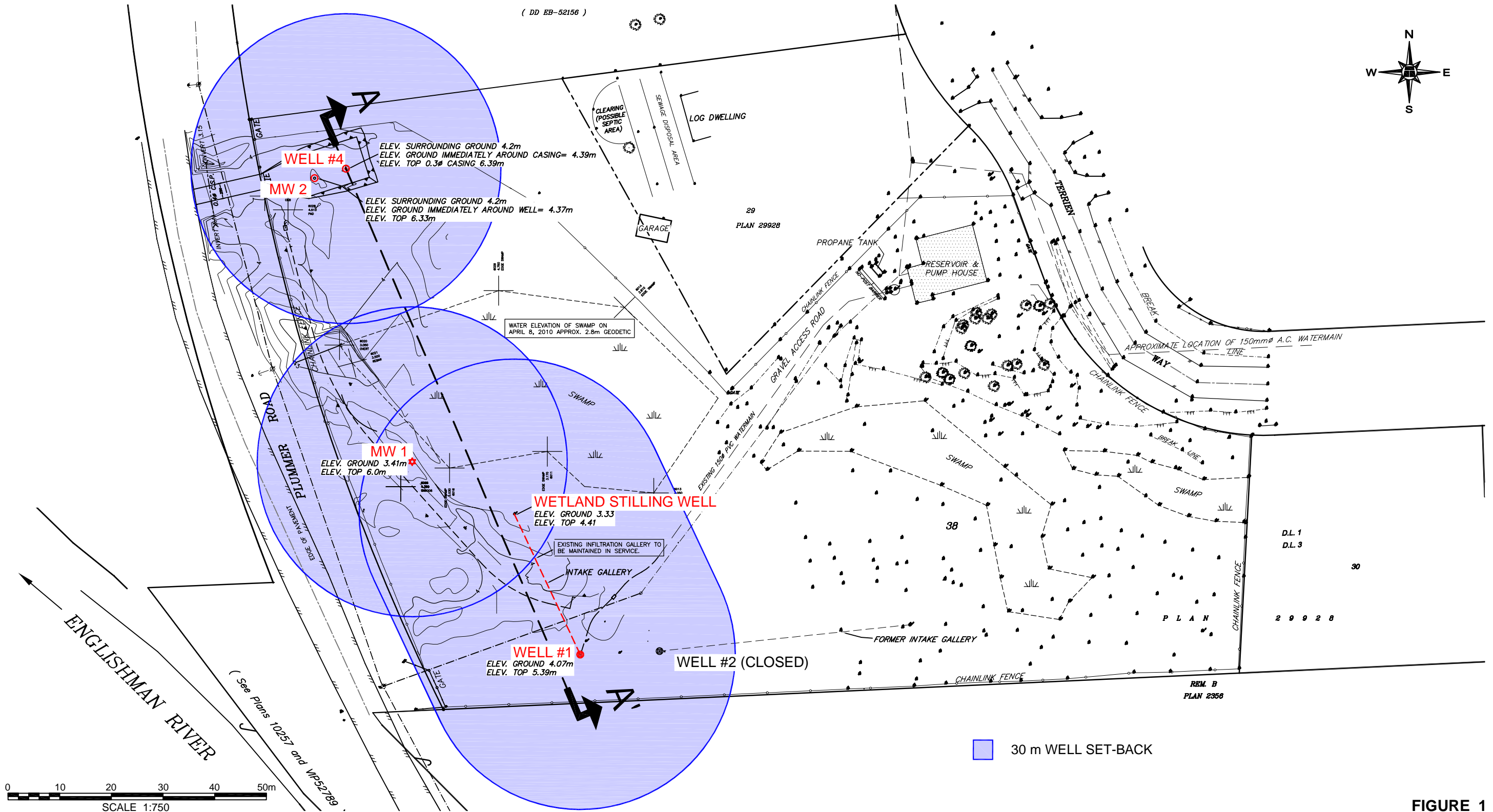


FIGURE 1



REGIONAL DISTRICT OF NANAIMO  
SAN PAREIL GUDI ASSESSMENT

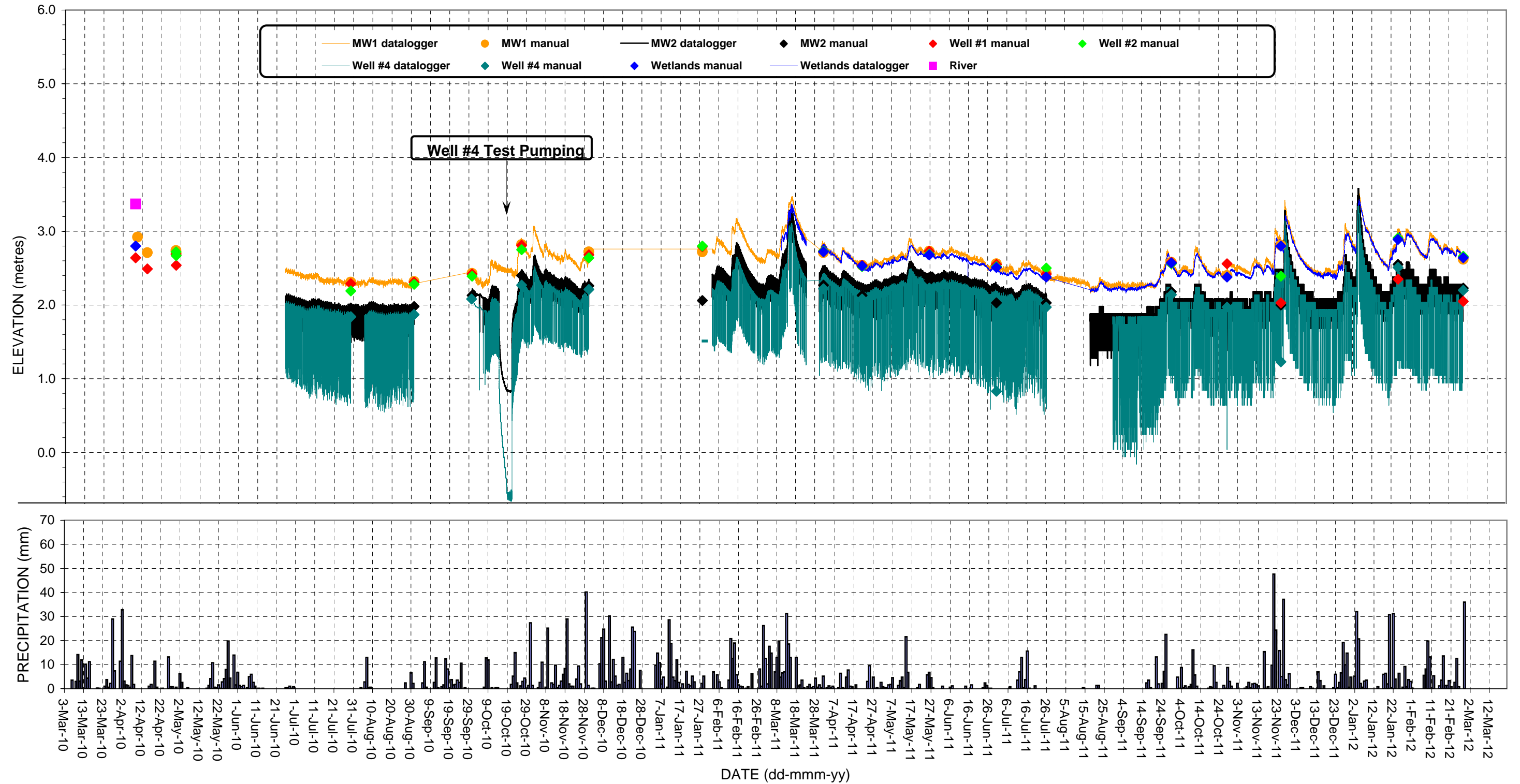


FIGURE 2



# North Island Laboratories

• 2755 B Moray Avenue, Courtenay, B.C. V9N 8M9 Tel: (250) 338-7786 Fax: (250) 338-7553

## Certificate of Analysis

Report To: Regional District of Nanaimo  
Chad Petersmeyer

Lab Number: 88643  
Date Reported: 28 Jun 11  
Date Completed: 28 Jun 11  
Date Received: 27 Jun 11 13:44

**88643-01 San Pareil #1 well water**

Sampled By: H. Dorken  
Sampling Date: 27 Jun 11 9:13

Test	Result	Units	Drinking Water Guideline
Total Coliforms (DES)	2.0	MPN/100mL	<1
E. coli (DES)	<1.0	MPN/100mL	<1

**88643-02 San Pareil #4 well water**

Sampled By: H. Dorken  
Sampling Date: 27 Jun 11 9:40

Test	Result	Units	Drinking Water Guideline
Total Coliforms (DES)	<1.0	MPN/100mL	<1
E. coli (DES)	<1.0	MPN/100mL	<1

**88643-01**

Test	Method	Analyst	Date
E. coli (DES)	Enzyme Substrate, APHA 9223 B -modified	NiSL	27/06/2011
Total Coliforms (DES)	Enzyme Substrate, APHA 9223 B -modified	NiSL	27/06/2011

Approved By:

Catherine Black, Owner/Operator

AO = Aesthetic Objective; MAC = Max. Allowable Concentration; IMAC = Interim MAC  
> = Greater than; < = Less than  
Results relate only to samples as submitted. This certificate must not be reproduced,  
except in its entirety, without written consent from the laboratory.  
Canadian Drinking Water Guidelines as listed on Dec. 5th, 2005 and are subject to

28/06/2011 16:57

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# North Island Laboratories

• 2755 B Moray Avenue, Courtenay, B.C. V9N 8M9 Tel: (250) 338-7786 Fax: (250) 338-7553

## Certificate of Analysis

Report To: Regional District of Nanaimo  
Chad Petersmeyer

Lab Number: 89250  
Date Reported: 27 Jul 11  
Date Completed: 27 Jul 11  
Date Received: 25 Jul 11 15:14

**89250-01 San Pareil #1 well water**

Sampled By: H. Dorken  
Sampling Date: 25 Jul 11 9:39

Test	Result	Units	Drinking Water Guideline
Total Coliforms (DES)	4.2	MPN/100mL	<1
E. coli (DES)	<1.0	MPN/100mL	<1

**89250-02 San Pareil #4 well water**

Sampled By: H. Dorken  
Sampling Date: 25 Jul 11 9:58

Test	Result	Units	Drinking Water Guideline
Total Coliforms (DES)	<1.0	MPN/100mL	<1
E. coli (DES)	<1.0	MPN/100mL	<1

**89250-01**

Test	Method	Analyst	Date
E. coli (DES)	Enzyme Substrate, APHA 9223 B -modified	NiSL	25/07/2011
Total Coliforms (DES)	Enzyme Substrate, APHA 9223 B -modified	NiSL	25/07/2011

Approved By:

Catherine Black, Owner/Operator

AO = Aesthetic Objective; MAC = Max. Allowable Concentration; IMAC = Interim MAC  
> = Greater than; < = Less than  
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Canadian Drinking Water Guidelines as listed on Dec. 5th, 2005 and are subject to

27/07/2011 12:39

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# North Island Laboratories

• 2755 B Moray Avenue, Courtenay, B.C. V9N 8M9 Tel: (250) 338-7786 Fax: (250) 338-7553

## Certificate of Analysis

Report To: Regional District of Nanaimo  
Chad Petersmeyer

Lab Number: 90031  
Date Reported: 30 Aug 11  
Date Completed: 30 Aug 11  
Date Received: 29 Aug 11 13:11

**90031-01 San Pareil well #1 raw water**

Sampled By: L. Jaworski  
Sampling Date: 29 Aug 11 9:30

Test	Result	Units	Drinking Water Guideline
Total Coliforms (DES)	1.0	MPN/100mL	<1
E. coli (DES)	<1.0	MPN/100mL	<1

**90031-02 San Pareil well #4 raw water**

Sampled By: L. Jaworski  
Sampling Date: 29 Aug 11 10:00

Test	Result	Units	Drinking Water Guideline
Total Coliforms (DES)	1.0	MPN/100mL	<1
E. coli (DES)	<1.0	MPN/100mL	<1

**90031-01**

HE: bottle written #4, paperwork written #2, logged as #4

Test	Method	Analyst	Date
E. coli (DES)	Enzyme Substrate, APHA 9223 B -modified	NiSL	29/08/2011
Total Coliforms (DES)	Enzyme Substrate, APHA 9223 B -modified	NiSL	29/08/2011

Approved By: 

Catherine Black, Owner/Operator

AO = Aesthetic Objective; MAC = Max. Allowable Concentration; IMAC = Interim MAC

> = Greater than; < = Less than

Results relate only to samples as submitted. This certificate must not be reproduced, except in its entirety, without written consent from the laboratory.

Canadian Drinking Water Guidelines as listed on Dec. 5th, 2005 and are subject to

30/08/2011 17:13

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# North Island Laboratories

• 2755 B Moray Avenue, Courtenay, B.C. V9N 8M9 Tel: (250) 338-7786 Fax: (250) 338-7553

## Certificate of Analysis

Report To: Regional District of Nanaimo  
Chad Petersmeyer

Lab Number: 90584  
Date Reported: 23 Sep 11  
Date Completed: 22 Sep 11  
Date Received: 21 Sep 11 14:51

**90584-01 San Pareil well #1 well water**

Sampled By: H Dorken  
Sampling Date: 21 Sep 11 9:33

Test	Result	Units	Drinking Water Guideline
Total Coliforms (DES)	3.1	MPN/100mL	<1
E. coli (DES)	<1.0	MPN/100mL	<1

**90584-02 San Pareil well #4 well water**

Sampled By: H Dorken  
Sampling Date: 21 Sep 11 9:58

Test	Result	Units	Drinking Water Guideline
Total Coliforms (DES)	<1.0	MPN/100mL	<1
E. coli (DES)	<1.0	MPN/100mL	<1

**90584-01**

Test	Method	Analyst	Date
E. coli (DES)	Enzyme Substrate, APHA 9223 B -modified	NiSL	21/09/2011
Total Coliforms (DES)	Enzyme Substrate, APHA 9223 B -modified	NiSL	21/09/2011

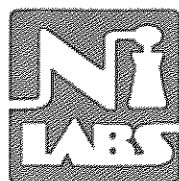
Approved By: 

Catherine Black, Owner/Operator

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23/09/2011 10:50

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# North Island Laboratories

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## Certificate of Analysis

Report To: Regional District of Nanaimo  
Attn: Heather Dorken  
6300 Hammond Bay Rd  
Nanaimo, BC  
V9T 6N2

Lab Number: 91211  
Date Reported: 31 Oct 11  
Date Completed: 31 Oct 11  
Date Received: 20 Oct 11 12:23

91211-01 San Pareil #1 well water  
Sampled By: H Dorken  
Sampling Date: 19 Oct 11 13:56

Test	Result	Units	Drinking Water Guideline
Colour - Apparent	<5	Colour units	
Total Coliforms (DES)	9.9	MPN/100mL	<1
E. coli (DES)	<1.0	MPN/100mL	<1
Fluoride	<0.1	mg/L	1.5 MAC
Chloride	6.1	mg/L	250 AO
Nitrate (N)	0.08	mg/L	10 MAC
Nitrite (N)	<0.01	mg/L	1 MAC
Sulphate	1.6	mg/L	500 AO
T-Aluminium	0.009	mg/L	0.1 Operational Std.
T-Antimony	<0.0002	mg/L	0.006 MAC
T-Arsenic	<0.0002	mg/L	0.010 MAC
T-Barium	0.004	mg/L	1.0 MAC
T-Beryllium	<0.00004	mg/L	
T-Bismuth	<0.001	mg/L	
T-Boron	0.018	mg/L	5 IMAC
T-Cadmium	<0.00001	mg/L	0.005 MAC
T-Calcium	8.28	mg/L	
T-Chromium	<0.0004	mg/L	0.05 MAC
T-Cobalt	0.00004	mg/L	
T-Copper	0.012	mg/L	1.0 AO
T-Iron	0.022	mg/L	0.3 AO
T-Lead	0.0012	mg/L	0.010 MAC
T-Lithium	<0.001	mg/L	
T-Magnesium	1.03	mg/L	
T-Manganese	<0.005	mg/L	0.05 AO
T-Molybdenum	<0.0001	mg/L	
T-Nickel	<0.001	mg/L	

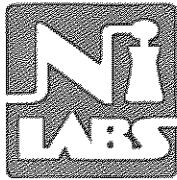
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# North Island Laboratories

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91211-01 San Pareil #1 well water

Sampled By: H Dorken

Sampling Date: 19 Oct 11 13:56

Test	Result	Units	Drinking Water Guideline
T-Phosphorus	<0.01	mg/L	
T-Potassium	0.8	mg/L	
T-Selenium	0.0063	mg/L	0.01 MAC
T-Silicon	2.5	mg/L	
T-Silver	<0.00001	mg/L	
T-Sodium	4.74	mg/L	200 AO
T-Strontium	0.036	mg/L	
T-Thallium	<0.00001	mg/L	
T-Tin	<0.0001	mg/L	
T-Titanium	<0.001	mg/L	
T-Uranium	<0.0004	mg/L	0.02 MAC
T-Vanadium	0.0005	mg/L	
T-Zinc	0.012	mg/L	5 AO
Hardness (CaCO <sub>3</sub> )	25	mg/L	
pH	7.1	pH Units	6.5-8.5
Alkalinity	22	mg/L (CaCO <sub>3</sub> )	
Turbidity	<0.5	NTU's	5 AO
Conductivity	69.9	uS/cm	
T-Mercury	<0.00001	mg/L	0.001 MAC
Total Dissolved Solids	14	mg/L	500 AO

91211-02 San Pareil #4 well water

Sampled By: H Dorken

Sampling Date: 19 Oct 11 14:11

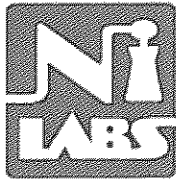
Test	Result	Units	Drinking Water Guideline
Colour - Apparent	<5	Colour units	
Total Coliforms (DES)	1.0	MPN/100mL	<1
E. coli (DES)	<1.0	MPN/100mL	<1
Fluoride	<0.1	mg/L	1.5 MAC
Chloride	7.1	mg/L	250 AO
Nitrate (N)	0.08	mg/L	10 MAC
Nitrite (N)	<0.01	mg/L	1 MAC
Sulphate	1.5	mg/L	500 AO

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# North Island Laboratories

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91211-02 San Pareil #4 well water

Sampled By: H Dorken

Sampling Date: 19 Oct 11 14:11

Test	Result	Units	Drinking Water Guideline
T-Aluminium	0.023	mg/L	0.1 Operational Std.
T-Antimony	<0.0002	mg/L	0.006 MAC
T-Arsenic	<0.0002	mg/L	0.010 MAC
T-Barium	0.002	mg/L	1.0 MAC
T-Beryllium	<0.00004	mg/L	
T-Bismuth	<0.001	mg/L	
T-Boron	0.014	mg/L	5 IMAC
T-Cadmium	<0.00001	mg/L	0.005 MAC
T-Calcium	8.74	mg/L	
T-Chromium	<0.0004	mg/L	0.05 MAC
T-Cobalt	0.00006	mg/L	
T-Copper	0.006	mg/L	1.0 AO
T-Iron	0.033	mg/L	0.3 AO
T-Lead	0.0006	mg/L	0.010 MAC
T-Lithium	<0.001	mg/L	
T-Magnesium	1.24	mg/L	
T-Manganese	0.018	mg/L	0.05 AO
T-Molybdenum	<0.0001	mg/L	
T-Nickel	<0.001	mg/L	
T-Phosphorus	<0.010	mg/L	
T-Potassium	0.9	mg/L	
T-Selenium	0.0052	mg/L	0.01 MAC
T-Silicon	2.98	mg/L	
T-Silver	<0.00001	mg/L	
T-Sodium	4.54	mg/L	200 AO
T-Strontium	0.036	mg/L	
T-Thallium	<0.00001	mg/L	
T-Tin	<0.0001	mg/L	
T-Titanium	0.01	mg/L	
T-Uranium	<0.0004	mg/L	0.02 MAC
T-Vanadium	0.0005	mg/L	
T-Zinc	0.003	mg/L	5 AO
Hardness (CaCO <sub>3</sub> )	27	mg/L	
pH	6.8	pH Units	6.5-8.5

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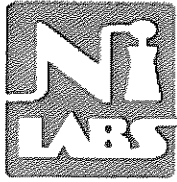
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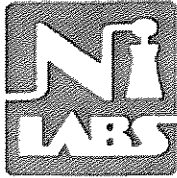
• 2755 B Moray Avenue, Courtenay, B.C. V9N 8M9 Tel: (250) 338-7786 Fax: (250) 338-7553

91211-02 San Pareil #4 well water

Sampled By: H Dorken

Sampling Date: 19 Oct 11 14:11

Test	Result	Units	Drinking Water Guideline
Alkalinity	21	mg/L (CaCO <sub>3</sub> )	
Turbidity	<0.5	NTU's	5 AO
Conductivity	74.9	uS/cm	
T-Mercury	<0.00001	mg/L	0.001 MAC
Total Dissolved Solids	28	mg/L	500 AO



# North Island Laboratories

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## Certificate of Analysis

Report To: Regional District of Nanaimo  
Attn: Heather Dorken  
6300 Hammond Bay Rd  
Nanaimo, BC  
V9T 6N2

Lab Number: 91799  
Date Reported: 5 Dec 11  
Date Completed: 5 Dec 11  
Date Received: 22 Nov 11 10:25

**91799-02 San Pareil #1 well water**

Sampled By: LJ / HD  
Sampling Date: 21 Nov 11 13:28

Test	Result	Units	Drinking Water Guideline
Total Coliforms (DES)	8.7	MPN/100mL	<1
E. coli (DES)	<1.0	MPN/100mL	<1

**91799-03 San Pareil #4 well water**

Sampled By: LJ / HD  
Sampling Date: 21 Nov 11 13:40

Test	Result	Units	Drinking Water Guideline
Total Coliforms (DES)	1.0	MPN/100mL	<1
E. coli (DES)	<1.0	MPN/100mL	<1

AO = Aesthetic Objective; MAC = Max. Allowable Concentration; IMAC = Interim MAC

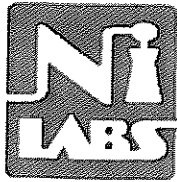
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05/12/2011 09:29

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## Certificate of Analysis

Report To: Regional District of Nanaimo  
Attn: Heather Dorken  
6300 Hammond Bay Rd  
Nanaimo, BC  
V9T 6N2

Lab Number: 92210  
Date Reported: 12 Dec 11  
Date Completed: 12 Dec 11  
Date Received: 8 Dec 11 10:03

92210-04 San Pareil #1 well

Sampled By:

Sampling Date: 7 Dec 11 11:33

Test	Result	Units	Drinking Water Guideline
Total Coliforms (DES)	19.2	MPN/100mL	<1
E. coli (DES)	<1.0	MPN/100mL	<1

92210-05 San Pareil #4 well

Sampled By:

Sampling Date: 7 Dec 11 11:49

Test	Result	Units	Drinking Water Guideline
Total Coliforms (DES)	6.4	MPN/100mL	<1
E. coli (DES)	<1.0	MPN/100mL	<1

92210-01

Test	Method	Analyst	Date
E. coli (DES)	Enzyme Substrate, APHA 9223 B -modified	NIsL	12/8/2011
Total Coliforms (DES)	Enzyme Substrate, APHA 9223 B -modified	NIsL	12/8/2011

Approved By:

Catherine Black, Owner/Operator



# North Island Laboratories

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## Certificate of Analysis

Report To: Regional District of Nanaimo  
Attn: Heather Dorken  
6300 Hammond Bay Rd  
Nanaimo, BC  
V9T 6N2

Lab Number: 92942  
Date Reported: 26 Jan 12  
Date Completed: 26 Jan 12  
Date Received: 24 Jan 12 13:44

**92942-01 San Pareil #1 well water**

Sampled By: L. Jawoski  
Sampling Date: 23 Jan 12 0:00

Test	Result	Units	Drinking Water Guideline
Total Coliforms (DES)	4.2	MPN/100mL	<1
E. coli (DES)	<1.0	MPN/100mL	<1

**92942-02 San Pareil #4 well water**

Sampled By:  
Sampling Date: 23 Jan 12 0:00

Test	Result	Units	Drinking Water Guideline
Total Coliforms (DES)	<1.0	MPN/100mL	<1
E. coli (DES)	<1.0	MPN/100mL	<1

**92942-01**

Test	Method	Analyst	Date
E. coli (DES)	Enzyme Substrate, APHA 9223 B -modified	NiSL	1/24/2012
Total Coliforms (DES)	Enzyme Substrate, APHA 9223 B -modified	NiSL	1/24/2012

Approved By: 

Catherine Black, Owner/Operator

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# North Island Laboratories

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## Certificate of Analysis

Report To: Regional District of Nanaimo  
Attn: Heather Dorken  
6300 Hammond Bay Rd  
Nanaimo, BC  
V9T 6N2

Lab Number: 93672  
Date Reported: 2 Mar 12  
Date Completed: 2 Mar 12  
Date Received: 29 Feb 12 13:27

**93672-01 San Pareil #1 well water**

Sampled By: H. Dorken  
Sampling Date: 29 Feb 12 14:20

Test	Result	Units	Drinking Water Guideline
Total Coliforms (DES)	<1.0	MPN/100mL	<1
E. coli (DES)	<1.0	MPN/100mL	<1

**93672-02 San Pareil #4 well water**

Sampled By:  
Sampling Date: 29 Feb 12 14:42

Test	Result	Units	Drinking Water Guideline
Total Coliforms (DES)	2.0	MPN/100mL	<1
E. coli (DES)	<1.0	MPN/100mL	<1

**93672-01**

Test	Method	Analyst	Date
E. coli (DES)	Enzyme Substrate, APHA 9223 B -modified	NiSL	2/29/2012
Total Coliforms (DES)	Enzyme Substrate, APHA 9223 B -modified	NiSL	2/29/2012

Approved By:

Catherine Black, Owner/Operator

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3/2/2012 09:43

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# North Island Laboratories

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## Certificate of Analysis

Report To: Regional District of Nanaimo  
Chad Petersmeyer

Lab Number: 94289  
Date Reported: 30 Mar 12  
Date Completed: 30 Mar 12  
Date Received: 29 Mar 12 15:10

**94289-01 San Pareil #1 well water**

Sampled By: H. Dorken  
Sampling Date: 29 Mar 12 9:12

Test	Result	Units	Drinking Water Guideline
Total Coliforms (DES)	<1.0	MPN/100mL	<1
E. coli (DES)	<1.0	MPN/100mL	<1

**94289-02 San Pareil #4 well water**

Sampled By:  
Sampling Date: 29 Mar 12 9:30

Test	Result	Units	Drinking Water Guideline
Total Coliforms (DES)	3.1	MPN/100mL	<1
E. coli (DES)	<1.0	MPN/100mL	<1

**94289-01**

Test	Method	Analyst	Date
E. coli (DES)	Enzyme Substrate, APHA 9223 B -modified	NiSL	3/29/2012
Total Coliforms (DES)	Enzyme Substrate, APHA 9223 B -modified	NiSL	3/29/2012

Approved By:

Catherine Black, Owner/Operator

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3/30/2012 16:17

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### MICROSCOPIC PARTICULATE ANALYSIS REPORT SHEET (GUDI)

**CLIENT:** Chad Petersmeyer  
Thurber Engineering  
100, 4396 West Saanich Rd.  
Victoria, BC  
V8Z 3E9  
**TELEPHONE:** (250) 727-2201  
**FAX:** (250) 727-3710

**Date of Sample:** 27-Jul-11  
**Sample Location:** RDN-PW#1  
**Type:** Raw  
**Volume Filtered (L):** 100  
**Temperature (°C):** 11.4  
**pH:** 5.87  
**Conductivity:** 60

The methodology used to generate this report conforms to the USEPA Consensus Method for the Microscopic Particulate Analysis. Based on the validation data, the method is fit for its intended use. Hyperion Research Ltd. is accredited for this analysis by CALA under the ISO/IEC 17025:2005 standard.

Sample Processing Information					Final Pellet Vol. (µL): 20.0	
<b>Date Received</b> 28-Jul-11	<b>Time Received</b> 1315	<b>Customer #</b> 123	<b>Temp. on Arrival (°C)</b> 18.8	<b>Lab ID</b> 51214	<b>Density Medium</b>	<b>Sediment (mL)</b> 0.10
<b>Total Wash (mL)</b> 1200	<b>Concentrated (mL)</b> 1200	<b>G/C Volume (µL)</b> 100	<b>MPA Volume (µL)</b> 100	<b>Suspension Vol. (µL)</b> 100	<b>Equiv. Vol. (L)</b> 100	

**GIARDIA and CRYPTOSPORIDIUM RESULTS**

*Giardia* cysts/100 L: 0.00                      *Cryptosporidium* oocysts/100 L: 0.00

### PARTICULATE ANALYSIS RESULTS

Primary Particulates	Total Count	#/380 L (100 US gal.)	Relative Risk Factor
Diatoms:	0	0.00	NS
Other Algae:	262	995.60	EH
Insect/larvae:	0	0.00	NS
Rotifers:	6	22.80	M
Plant Debris:	8	30.40	M
Relative Risk Factors: EH - extremely heavy M - moderate H - heavy R - Rare NS - not significant			

Secondary Particulates	Total Count	#/380 L (100 US gal.)
Pollen	24	91.2
Nematodes	0	0.0
Crustacea	0	0
Amoebae	0	0
Ciliates/flagellates	0	0
Other	0	0
Large Debris	none	
Fine Debris	silica, clay	
Minerals	iron	

**CONCLUSION:** Based on this sample, the risk of surface water contamination is judged to be moderate and the risk factor is 17

**Additional Data:** Surface water contains variety of algae.

**Analyst:**

Peter M. Wallis, Ph.D.

From the EPA Consensus Method:

Risk of Surface Water Contamination

20+ - high risk  
10 to 19 - moderate risk  
0 to 9 - low risk

Recovery efficiencies for particles are known to be low by this method but are compensated for by filtering a large volume of water. Minimum recovery was measured to be 6.5 +/-1.2% for *Giardia* cysts, 0.5 +/-0.2% for *Cryptosporidium* oocysts and 4.2 +/-2.3% for *Euglena* (algae). Despite the low recovery, the method reliably detected as few as 1 cell/L of groundwater in validation trials with no false positives.



### MICROSCOPIC PARTICULATE ANALYSIS REPORT SHEET (GUDI)

**CLIENT:** Chad Petersmeyer  
Thurber Engineering  
100, 4396 West Saanich Rd.  
Victoria, BC  
V8Z 3E9  
**TELEPHONE:** (250) 727-2201  
**FAX:** (250) 727-3710

**Date of Sample:** 27-Jul-11  
**Sample Location:** RDN-PW#4  
**Type:** Raw  
**Volume Filtered (L):** 100  
**Temperature (°C):** 9.9  
**pH:** 6.02  
**Conductivity:** 64.5

The methodology used to generate this report conforms to the USEPA Consensus Method for the Microscopic Particulate Analysis. Based on the validation data, the method is fit for its intended use. Hyperion Research Ltd. is accredited for this analysis by CALA under the ISO/IEC 17025:2005 standard.

Sample Processing Information					Final Pellet Vol. (µL): 100.0	
<b>Date Received</b> 28-Jul-11	<b>Time Received</b> 1315	<b>Customer #</b> 123	<b>Temp. on Arrival (°C)</b> 18.8	<b>Lab ID</b> 51215	<b>Density Medium</b>	<b>Sediment (mL)</b> 0.20
<b>Total Wash (mL)</b> 1200	<b>Concentrated (mL)</b> 1200	<b>G/C Volume (µL)</b> 100	<b>MPA Volume (µL)</b> 100	<b>Suspension Vol. (µL)</b> 100	<b>Equiv. Vol. (L)</b> 100	

<b>GIARDIA and CRYPTOSPORIDIUM RESULTS</b>	
<b>Giardia cysts/100 L:</b> 0.00	<b>Cryptosporidium oocysts/100 L:</b> 0.00

### PARTICULATE ANALYSIS RESULTS

Primary Particulates	Total Count	#/380 L (100 US gal.)	Relative Risk Factor
Diatoms:	0	0.00	NS
Other Algae:	63	239.40	H
Insect/larvae:	0	0.00	NS
Rotifers:	0	0.00	NS
Plant Debris:	0	0.00	NS
Relative Risk Factors: EH - extremely heavy M - moderate H - heavy R - Rare NS - not significant			

Secondary Particulates	Total Count	#/380 L (100 US gal.)
Pollen	0	0.0
Nematodes	0	0.0
Crustacea	0	0
Amoebae	0	0
Ciliates/flagellates	0	0
Other	0	0
Large Debris	none	
Fine Debris	high silica	
Minerals	iron, clay	

**CONCLUSION:** Based on this sample, the risk of surface water contamination is judged to be moderate and the risk factor is **12**

**Additional Data:** Surface water contains variety of algae.

**Analyst:**

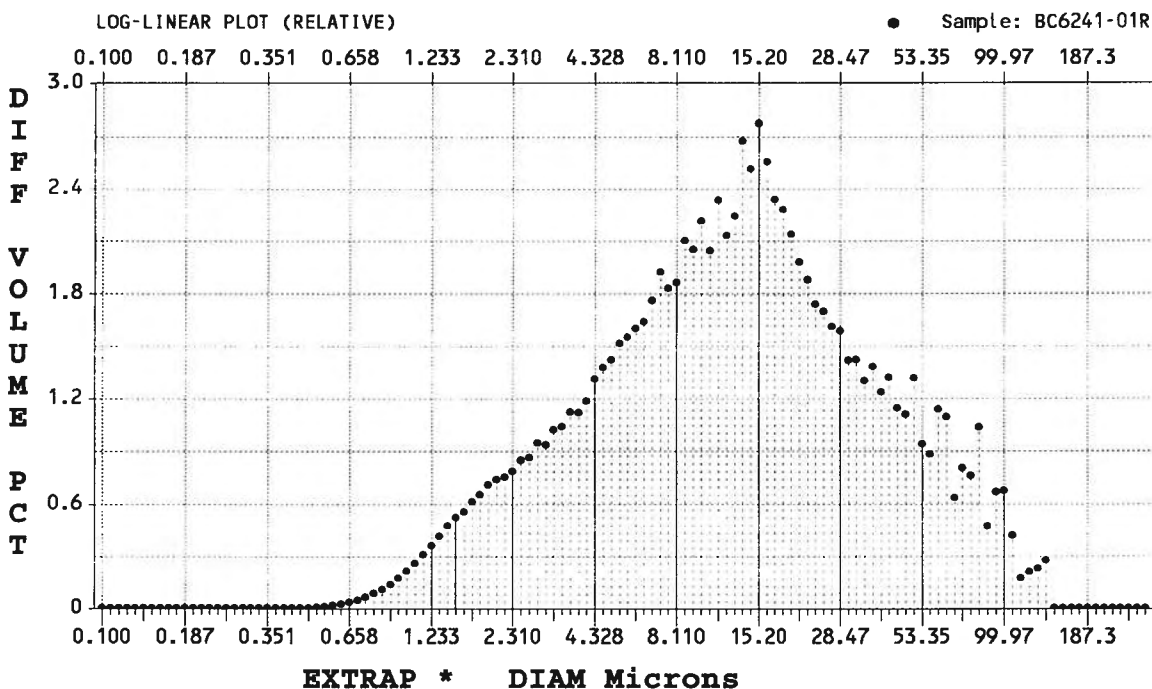
Peter M. Wallis, Ph.D.

From the EPA Consensus Method:	
<u>Risk of Surface Water Contamination</u>	
20+	- high risk
10 to 19	- moderate risk
0 to 9	- low risk

Recovery efficiencies for particles are known to be low by this method but are compensated for by filtering a large volume of water. Minimum recovery was measured to be 6.5 +/-1.2% for *Giardia* cysts, 0.5 +/-0.2% for *Cryptosporidium* oocysts and 4.2 +/-2.3% for *Euglena* (algae). Despite the low recovery, the method reliably detected as few as 1 cell/L of groundwater in validation trials with no false positives.

NBK Mining Engineering Department  
 University of British Columbia  
**PARTICLE SIZE DISTRIBUTION BY ELZONE**  
 Particle Size Distribution for Maxxam Analytics  
 Sample ID: Water sample BC6241-01R \ PW4  
 Tested for Tabitha Rudkin (Job #: B168246)  
 Received July 29, 2011; Tested August 04, 2011  
 Tested ~1.2 - 200 microns  
 Extrapolated 0 - 1.5 microns

Sample: BC6241-01R Material: water  
 Date: 23:02 04 Aug 11 Operator: Esau Arinaitwe



Geometric Mean Size:	12.49 um	-- PERCENTILES --
Geom. Std Deviation:	2.982 um	10.00% Volume below 2.771 um
Geom. Skewness:	-0.968	20.00% Volume below 4.846 um
Geom. Coeff Variation:	23.87	30.00% Volume below 7.194 um
		50.00% Volume below 13.13 um
Arithmetic Mean Size:	21.54 um	60.00% Volume below 16.68 um
Median Size:	12.87 um	80.00% Volume below 32.72 um
Mode Size:	15.38 um	90.00% Volume below 53.94 um
Kurtosis:	5.024	
Arith Std Deviation	25.58 um	

**ELZONE<sup>(tm)</sup> Particle Size Analysis**

For: Maxxam Analytics  
Tabitha Rudkin

By: Esau Arinaitwe/Sally Finora

Operator: Esau Arinaitwe

Comments:

Sampled representatively, diluted  
with NaCl and tested over two ranges

Electrolyte:

1% & 4% NaCl solution

Date done: 23:02 04 Aug 111

Disk File: MX6241AX.HST

Sample #: BC6241-01R

Lot/Job #: \ PW4

Material: water

Source:

-- PERCENTILES --

0.751%	Volume below	0.999 um
5.839%	Volume below	1.998 um
11.18%	Volume below	2.998 um
20.71%	Volume below	5.000 um
31.35%	Volume below	7.500 um
40.41%	Volume below	9.998 um
48.21%	Volume below	12.50 um
55.46%	Volume below	15.00 um
66.61%	Volume below	20.00 um
73.30%	Volume below	24.99 um
78.01%	Volume below	30.00 um
81.40%	Volume below	35.00 um
83.22%	Volume below	37.97 um
84.23%	Volume below	39.99 um
86.20%	Volume below	43.98 um
88.56%	Volume below	49.98 um
90.00%	Volume below	53.95 um
91.52%	Volume below	59.99 um
93.92%	Volume below	69.99 um
94.78%	Volume below	74.97 um
95.55%	Volume below	79.97 um
97.12%	Volume below	89.99 um
98.22%	Volume below	99.95 um
99.28%	Volume below	118.7 um
100.0%	Volume below	138.9 um
100.0%	Volume below	138.9 um
100.0%	Volume below	138.9 um
100.0%	Volume below	138.9 um

- Well Construction Report  
 Well Closure Report  
 Well Alteration Report

Ministry Well ID Plate Number: 33649  
 Ministry Well Tag Number:  
 Confirmation/alternative specs. attached  
 Original well construction report attached

*Change authority, name, location, or other information must be reported to the Ministry.*

**Red lettering indicates minimum mandatory information. See reverse for notes & definitions of abbreviations.**

Owner name: **Regional District of Nanaimo**

Mailing address: **6300 Hammond bay RD** Town **Nanaimo** Prov. **BC** Postal Code **V9T 6N2**

Well Location: Address: Street no. **1090** Street name **Plummer RD** Town **Parksville**

(or) Legal description: Lot Plan D.L. Block Sec. Twp. Rg. Land District

(or) PID: (and) Description of well location (attach sketch, if nec.):

NAD 83: Zone: (see note 2) UTM Easting: m (or) UTM Northing: m Latitude (see note 3): **N 49° 19.280'** Longitude: **W 124° 17.173'**

Method of drilling:  air rotary  cable tool  mud rotary  auger  driving  jetting  excavating  other (specify):

Orientation of well:  vertical  horizontal Ground elevation: ft (asl) Method (see note 4):

Class of well (see note 5): **Monitoring** Sub-class of well: **Permanent**

Water supply wells: indicate intended water use:  private domestic  water supply system  irrigation  commercial or industrial  other (specify):

**Lithologic description (see notes 7-14) or closure description (see notes 15 and 16)**

From ft (bgl)	To ft (bgl)	Relative Hardness	Colour	Material Description (Use recommended terms on reverse. List in order of decreasing amount, if applicable)	Water-bearing Estimated Flow (USgpm)	Observations (e.g., fractured, weathered, well sorted, silty wash), closure details

**Casing details**

From ft (bgl)	To ft (bgl)	Dia in	Casing Material / Open Hole	Wail Thickness in	Drive Shoe
See Attached					

**Screen details**

From ft (bgl)	To ft (bgl)	Dia in	Type (see note 18)	Slot Size

Surface seal: Type: \_\_\_\_\_ Depth: \_\_\_\_\_ ft

Method of installation:  Poured  Pumped Thickness: \_\_\_\_\_ in

Backfill: Type: \_\_\_\_\_ Depth: \_\_\_\_\_ ft

Liner:  PVC  Other (specify): \_\_\_\_\_

Diameter: \_\_\_\_\_ in Thickness: \_\_\_\_\_ in

From: \_\_\_\_\_ ft (bgl) To: \_\_\_\_\_ ft (bgl) Perforated: From: \_\_\_\_\_ ft (bgl) To: \_\_\_\_\_ ft (bgl)

Intake:  Screen  Open bottom  Uncased hole

Screen type:  Telescope  Pipe size

Screen material:  Stainless steel  Plastic  Other (specify): \_\_\_\_\_

Screen opening:  Continuous slot  Slotted  Perforated pipe

Screen bottom:  Bail  Plug  Plate  Other (specify): \_\_\_\_\_

Filter pack: From: \_\_\_\_\_ ft To: \_\_\_\_\_ ft Thickness: \_\_\_\_\_ in

Type and size of material: \_\_\_\_\_

**Developed by:**

Air lifting  Surging  Jetting  Pumping  Bailing

Other (specify): \_\_\_\_\_ Total duration: \_\_\_\_\_ hrs

Notes: \_\_\_\_\_

**Final well completion data:**

Total depth drilled: \_\_\_\_\_ ft Finished well depth: \_\_\_\_\_ ft (bgl)

Final stick up: \_\_\_\_\_ in Depth to bedrock: \_\_\_\_\_ ft (bgl)

SWL: \_\_\_\_\_ ft (btoc) Estimated well yield: \_\_\_\_\_ USgpm

Artesian flow: \_\_\_\_\_ USgpm, or Artesian pressure: \_\_\_\_\_ ft

Type of well cap: \_\_\_\_\_ Well disinfected:  Yes  No

Where well ID plate is attached: \_\_\_\_\_

**Well yield estimated by:**

Pumping  Air lifting  Bailing  Other (specify): \_\_\_\_\_

Rate: \_\_\_\_\_ USgpm Duration: \_\_\_\_\_ hrs

SWL before test: \_\_\_\_\_ ft (btoc) Pumping water level: \_\_\_\_\_ ft (btoc)

**Well closure information:**

Reason for closure: \_\_\_\_\_

Method of closure:  Poured  Pumped

Sealant material: \_\_\_\_\_ Backfill material: \_\_\_\_\_

Details of closure (see note 17): \_\_\_\_\_

**Obvious water quality characteristics:**

Fresh  Salty  Clear  Cloudy  Sediment  Gas

Colour/odour: \_\_\_\_\_ Water sample collected:

**Well driller (print clearly):**

Name (first, last) (see note 19): Ron Nelson

Registration no. (see note 20): WD 12062101

Consultant (if applicable; name and company): \_\_\_\_\_

**Date of work (YYYY/MM/DD):**

Started: 2012/07/16 Completed: 2012/07/16

Comments: \_\_\_\_\_

**DECLARATION:** Well construction, well alteration or well closure, as the case may be, has been done in accordance with the requirements in the Water Act and the Ground Water Protection Regulation.

**Signature of Driller Responsible** \_\_\_\_\_

**PLEASE NOTE:** The information recorded in this well report describes the works and hydrogeologic conditions at the time of construction, alteration or closure, as the case may be. Well yield, well performance and water quality are not guaranteed as they are influenced by a number of factors, including natural variability, human activities and condition of the works, which may change over time.

white: Customer copy  
canary: Driller copy  
pink: Ministry copy

## General

- Requirements for well construction and well closure reports are found in Part 5 of the *Water Act* and the Ground Water Protection Regulation. Part 5 of the act and regulation are at: [http://www.env.gov.bc.ca/wsd/plan\\_protect\\_sustain/groundwater/index.htm#eg](http://www.env.gov.bc.ca/wsd/plan_protect_sustain/groundwater/index.htm#eg).
- The current Ministry standard datum for mapping and geodetic use is the North American Datum of 1983 (NAD 83). To determine GPS coordinates using a Global Positioning System (GPS), set the datum to NAD 83.
- For latitude and longitude coordinates, provide coordinates either in degree, minutes and seconds (e.g., 50° 2' 21.037") or decimal degrees (e.g., 50.039175°).
- For the method of determining ground elevation, enter: GPS, differential GPS, level, altimeter, 1:50,000 map, 1:20,000 map, 1:10,000 map or 1:5,000 map.
- The classes and sub-classes of wells are shown below:

<b>Class</b>	<b>Sub-class</b> (if applicable)
Water supply .....	Domestic; Non-domestic
Monitoring .....	Temporary; Permanent
Recharge or injection	
Dewatering or drainage .....	Temporary; Permanent
Remediation .....	Temporary; Permanent
Geotechnical .....	Borehole; Test pit; Special type of hole; Closed loop geothermal
- Well reports submitted to the Deputy Comptroller, or retained by the person responsible, as required under the *Water Act* and the Ground Water Protection Regulation, shall be considered part of the Provincial Government records and subject to the *Freedom of Information and Protection of Privacy Act*.

## How to Fill Out the Lithologic Description Table

- Each row in the lithologic description table represents either a depth interval or depth in the well.
- A row could represent a depth interval (e.g., from 0 feet to 12 feet), such as for a geologic stratum or a specific depth (e.g., 120 feet), such as for a depth location of a water-bearing fracture.
- For a depth interval, enter the relative hardness of the material in the column "Relative Hardness," if applicable: Very Hard (VH), Hard (H), Dense (D), Stiff (ST), Medium (M), Loose (L), Soft (S), Very Soft (VS).
- For a depth interval, enter the letter for the overall colour of the geologic material in the column "Colour," if applicable: White (W), Grey (Gy), Blue (Bl), Green (G), Yellow (Y), Brown (Br), Red (R), Tan (T), Black (Bk).
- For each depth interval, enter the description of the geologic materials encountered during drilling in the column "Material Description." Material descriptions should be chosen from the following recommended list of materials:

<b>Surficial materials</b> (approximate range of particle size)	<b>Bedrock materials</b>
boulders (greater than 10 inches)	conglomerate
cobbles (2 1/2 inches to 10 inches)	sandstone
gravel (80 slot to 2 1/2 inches)	shale
coarse sand (25 slot to 80 slot)	siltstone
medium sand (10 slot to 25 slot)	limestone
fine sand (2 slot to 10 slot)	crystalline
silt (less than 2 slot)	granite
clay (much less than 2 slot)	basalt
till (variable particle size)	volcanic
organics (e.g., top soil, wood, peat)	bedrock
- In describing the material, list the material in order from greatest to least and indicate what materials occur in trace (less than 5%) amounts. The word "and" means both materials occur in approximately equal amounts (e.g., "gravel and coarse sand, trace silt").
- Under the column "Water-bearing Estimated Flow (USgpm)," use "D" for "dry," "W" for "wet," or enter the estimated flow in USgpm.
- If a water-bearing fracture is encountered, the depth of the fracture should be recorded in a row and the estimated flow of water in the fracture can be entered in the column "Water-bearing Estimated Flow (USgpm)."

## How to Fill Out the Closure Description Table and the Well Closure Information Section

- Each row in the closure description table represents either a depth interval (e.g., from 0 feet to 12 feet) or depth (e.g., 120 feet) in the well.
- For a depth interval, enter the type of backfill or sealant material(s) in the column "Material Description."
- Indicate in "Details of closure" whether casing(s) or screen(s) were pulled or left in place. If casing(s) were left in place, indicate whether it was perforated or ripped.

## Screen Details

- "Type" includes riser pipe, K-packer, screen, screen blank, or tail pipe.

## Well Driller

- Fill in the name of the driller who constructed the well.

## Registration Number of Driller Responsible

- Fill in the registration number on the Qualified Well Driller identification card. If the work was completed by a driller who is not registered as a Qualified Well Driller, the Qualified Well Driller who is directly supervising the work should fill in their registration number on their Qualified Well Driller identification card. The Qualified Well Driller signs the form.

## Definitions of Abbreviations

asl .....	above sea level	ft.....	feet	PID.....	Parcel Identifier	USgpm...	US gallons per minute
bgl .....	below ground level	hrs.....	hours	Rg.....	Range	UTM.....	Universal Transverse
btoc.....	below top of casing	in .....	inches	Sec.....	Section		Mercator Grid
Dia .....	Diameter	NAD 83 ..	North American	SWL .....	static water level		
D:L.....	District Lot		Datum (1983)	Twp.....	Township		

## Return Completed Forms to:

Ground Water Data Technician  
Water Stewardship Division, Ministry of Environment  
PO Box 9362 Stn Prov Govt  
Victoria BC V8W 9M2

updated: Jan. 18, 2007



Date of Upgrade:

16 JULY 2012

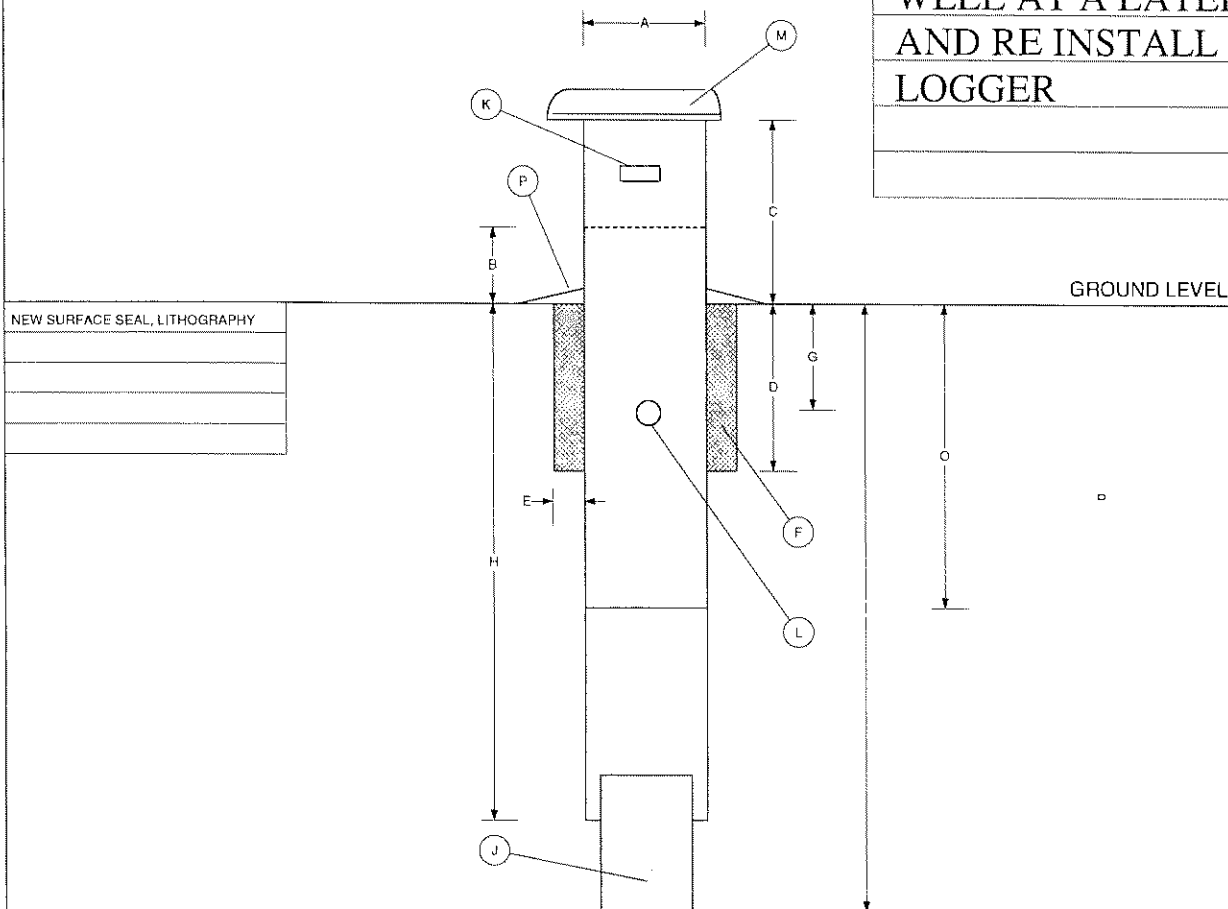
DRILLED WELL

WELL ID	
WELL ID PLATE	33649

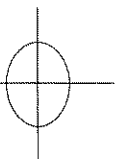
A-CASING DIAMETER	6 IN.
B-EXISTING CASING STCK UP	1.77 FT.
C-NEW CASING STICK UP,(MIN 12")	8.32 FT.
D-SURFACE SEAL DEPTH	UNKNOWN
E-WIDTH OF SURFACE SEAL	UNKNOWN
F-SEALING MATERIAL	UNKNOWN
G-PITLESS DEPTH	N/A
H-CASING DEPTH	10.55 FT.
I-BOTTOM OF HOLE	16.07 FT.
J-ROCK/SCREENED WELL	UNKNOWN
K-WELLID PLATE	33649
L-PITLESS	N/A
M-LOCK CAP, MODEL#	BIL 6 5/8 OD
O-STATIC WATER LEVEL	3.55 FT.
P-SLOPE AWAY FROM WELL	N/A

COMMENTS:

- EXTENDED CASING  
2 METERS
- CUSTOMER REMOVED  
DATA LOGGER AND WILL  
EXTEND 2IN. TUBE IN  
WELL AT A LATER DATE  
AND RE INSTALL DATA  
LOGGER



NEW SURFACE SEAL, LITHOGRAPHY



**PRECISION**

SERVICE & PUMPS INC.  
1334 RIVERSIDE ROAD  
ABBOTSFORD BC  
V2S8J2

WELL UPGRADES

WORK ORDER	DATE
8224	2012/07/16
WELL ID	TECH
33649	D.R



Ministry of Environment

- Well Construction Report
- Well Closure Report
- Well Alteration Report

Ministry Well ID Plate Number:  
 Ministry Well Tag Number: 13714  
 Confirmation/alternative specs. attached  
 Original well construction report attached

**Red lettering indicates minimum mandatory information.** See reverse for notes & definitions of abbreviations.

Owner name: **Regional District of Nanaimo**  
 Mailing address: **6300 Hammond Bay RD** Town **Nanaimo** Prov. **BC** Postal Code **V9T 6N2**  
 Well Location: Address: Street no. **1090** Street name **Plummer RD** Town **Parksville**

Legal description: Lot \_\_\_\_\_ Plan \_\_\_\_\_ D.L. \_\_\_\_\_ Block \_\_\_\_\_ Sec. \_\_\_\_\_ Twp. \_\_\_\_\_ Rg. \_\_\_\_\_ Land District \_\_\_\_\_  
 PID: \_\_\_\_\_  Description of well location (attach sketch, if nec.): \_\_\_\_\_

NAD 83: Zone: \_\_\_\_\_ UTM Easting: \_\_\_\_\_ m  Latitude (see note 3): **N 49° 19.295**  
 (see note 2)  UTM Northing: \_\_\_\_\_ m  Longitude: **W 124° 17.156**

Method of drilling:  air rotary  cable tool  mud rotary  auger  driving  jetting  excavating  other (specify): \_\_\_\_\_  
 Orientation of well:  vertical  horizontal Ground elevation: **111.55** ft (asl) Method (see note 4): **GPS**  
 Class of well (see note 5): **Water Supply** Sub-class of well: **Non-domestic**  
 Water supply wells: indicate intended water use:  private domestic  water supply system  irrigation  commercial or industrial  other (specify): \_\_\_\_\_

**Lithologic description** (see notes 7-14) or **closure description** (see notes 15 and 16)

From ft (bgl)	To ft (bgl)	Relative Hardness	Colour	Material Description (Use recommended terms on reverse. List in order of decreasing amount, if applicable)	Water-bearing Estimated Flow (USgpm)	Observations (e.g., fractured, weathered, well sorted, silty wash), closure details
0	2			Native Soil & 3/4 Gravel		
2	5.4			3/8 Bentonite		
5.4	10			3/4 Gravel		
10	17.2			3/8 Bentonite		

**Casing details**

From ft (bgl)	To ft (bgl)	Dia in	Casing Material / Open Hole	Wall Thickness in	Drive Shoe

**Screen details**

From ft (bgl)	To ft (bgl)	Dia in	Type (see note 18)	Slot Size

Surface seal: Type: \_\_\_\_\_ Depth: \_\_\_\_\_ ft  
 Method of installation:  Poured  Pumped Thickness: \_\_\_\_\_ in  
 Backfill: Type: \_\_\_\_\_ Depth: \_\_\_\_\_ ft  
 Liner:  PVC  Other (specify): \_\_\_\_\_  
 Diameter: \_\_\_\_\_ in Thickness: \_\_\_\_\_ in  
 From: \_\_\_\_\_ ft (bgl) To: \_\_\_\_\_ ft (bgl) Perforated: From: \_\_\_\_\_ ft (bgl) To: \_\_\_\_\_ ft (bgl)

Intake:  Screen  Open bottom  Uncased hole  
 Screen type:  Telescope  Pipe size  
 Screen material:  Stainless steel  Plastic  Other (specify): \_\_\_\_\_  
 Screen opening:  Continuous slot  Slotted  Perforated pipe  
 Screen bottom:  Bail  Plug  Plate  Other (specify): \_\_\_\_\_  
 Filter pack: From: \_\_\_\_\_ ft To: \_\_\_\_\_ ft Thickness: \_\_\_\_\_ in  
 Type and size of material: \_\_\_\_\_

**Developed by:**  
 Air lifting  Surging  Jetting  Pumping  Bailing  
 Other (specify): \_\_\_\_\_ Total duration: \_\_\_\_\_ hrs  
 Notes: \_\_\_\_\_

**Final well completion data:**  
 Total depth drilled: \_\_\_\_\_ ft Finished well depth: \_\_\_\_\_ ft (bgl)  
 Final stick up: \_\_\_\_\_ in Depth to bedrock: \_\_\_\_\_ ft (bgl)  
 SWL: \_\_\_\_\_ ft (btoc) Estimated well yield: \_\_\_\_\_ USgpm  
 Artesian flow: \_\_\_\_\_ USgpm, or Artesian pressure: \_\_\_\_\_ ft  
 Type of well cap: \_\_\_\_\_ Well disinfected:  Yes  No  
 Where well ID plate is attached: \_\_\_\_\_

**Well yield estimated by:**  
 Pumping  Air lifting  Bailing  Other (specify): \_\_\_\_\_  
 Rate: \_\_\_\_\_ USgpm Duration: \_\_\_\_\_ hrs  
 SWL before test: \_\_\_\_\_ ft (btoc) Pumping water level: \_\_\_\_\_ ft (btoc)

**Well closure information:**  
 Reason for closure: **Not In Use**  
 Method of closure:  Poured  Pumped  
 Sealant material: **3/8 Bentonite** Backfill material: **3/4 Gravel**  
 Details of closure (see note 17): **casing left in place**

**Obvious water quality characteristics:**  
 Fresh  Salty  Clear  Cloudy  Sediment  Gas  
 Colour/odour: \_\_\_\_\_ Water sample collected:

**Well driller** (print clearly):  
 Name (first, last) (see note 19): **Row Nelson**  
 Registration no. (see note 20): **WD 12062101**  
 Consultant (if applicable; name and company): \_\_\_\_\_

**Date of work** (YYYY/MM/DD):  
 Started: **2012/07/16** Completed: **2012/07/16**  
 Comments: \_\_\_\_\_

**DECLARATION:** Well construction, well alteration or well closure, as the case may be, has been done in accordance with the requirements in the Water Act and the Ground Water Protection Regulation.  
 Signature of Driller Responsible: \_\_\_\_\_

## General

1. Requirements for well construction and well closure reports are found in Part 5 of the *Water Act* and the Ground Water Protection Regulation. Part 5 of the act and regulation are at: [http://www.env.gov.bc.ca/wsd/plan\\_protect\\_sustain/groundwater/index.html#leg](http://www.env.gov.bc.ca/wsd/plan_protect_sustain/groundwater/index.html#leg).
2. The current Ministry standard datum for mapping and geodetic use is the North American Datum of 1983 (NAD 83). To determine GPS coordinates using a Global Positioning System (GPS), set the datum to NAD 83.
3. For latitude and longitude coordinates, provide coordinates either in degree, minutes and seconds (e.g., 50° 2' 21.037") or decimal degrees (e.g., 50.039175°).
4. For the method of determining ground elevation, enter: GPS, differential GPS, level, altimeter, 1:50,000 map, 1:20,000 map, 1:10,000 map or 1:5,000 map.
5. The classes and sub-classes of wells are shown below:
 

Class	Sub-class (if applicable)
Water supply .....	Domestic; Non-domestic
Monitoring.....	Temporary; Permanent
Recharge or injection	
Dewatering or drainage .....	Temporary; Permanent
Remediation .....	Temporary; Permanent
Geotechnical.....	Borehole; Test pit; Special type of hole; Closed loop geothermal
6. Well reports submitted to the Deputy Comptroller, or retained by the person responsible, as required under the *Water Act* and the Ground Water Protection Regulation, shall be considered part of the Provincial Government records and subject to the *Freedom of Information and Protection of Privacy Act*.

## How to Fill Out the Lithologic Description Table

7. Each row in the lithologic description table represents either a depth interval or depth in the well.
8. A row could represent a depth interval (e.g., from 0 feet to 12 feet), such as for a geologic stratum or a specific depth (e.g., 120 feet), such as for a depth location of a water-bearing fracture.
9. For a depth interval, enter the relative hardness of the material in the column "Relative Hardness," if applicable: Very Hard (VH), Hard (H), Dense (D), Stiff (ST), Medium (M), Loose (L), Soft (S), Very Soft (VS).
10. For a depth interval, enter the letter for the overall colour of the geologic material in the column "Colour," if applicable: White (W), Grey (Gy), Blue (Bl), Green (G), Yellow (Y), Brown (Br), Red (R), Tan (T), Black (Bk).
11. For each depth interval, enter the description of the geologic materials encountered during drilling in the column "Material Description." Material descriptions should be chosen from the following recommended list of materials:
 

Surficial materials (approximate range of particle size)	Bedrock materials
boulders (greater than 10 inches)	conglomerate
cobbles (2 1/2 inches to 10 inches)	sandstone
gravel (80 slot to 2 1/2 inches)	shale
coarse sand (25 slot to 80 slot)	siltstone
medium sand (10 slot to 25 slot)	limestone
fine sand (2 slot to 10 slot)	crystalline
silt (less than 2 slot)	granite
clay (much less than 2 slot)	basalt
till (variable particle size)	volcanic
organics (e.g., top soil, wood, peat)	bedrock
12. In describing the material, list the material in order from greatest to least and indicate what materials occur in trace (less than 5%) amounts. The word "and" means both materials occur in approximately equal amounts (e.g., "gravel and coarse sand, trace silt").
13. Under the column "Water-bearing Estimated Flow (USgpm)," use "D" for "dry," "W" for "wet," or enter the estimated flow in USgpm.
14. If a water-bearing fracture is encountered, the depth of the fracture should be recorded in a row and the estimated flow of water in the fracture can be entered in the column "Water-bearing Estimated Flow (USgpm)."

## How to Fill Out the Closure Description Table and the Well Closure Information Section

15. Each row in the closure description table represents either a depth interval (e.g., from 0 feet to 12 feet) or depth (e.g., 120 feet) in the well.
16. For a depth interval, enter the type of backfill or sealant material(s) in the column "Material Description."
17. Indicate in "Details of closure" whether casing(s) or screen(s) were pulled or left in place. If casing(s) were left in place, indicate whether it was perforated or ripped.

## Screen Details

18. "Type" includes riser pipe, K-packer, screen, screen blank, or tail pipe.

## Well Driller

19. Fill in the name of the driller who constructed the well.

## Registration Number of Driller Responsible

20. Fill in the registration number on the Qualified Well Driller identification card. If the work was completed by a driller who is not registered as a Qualified Well Driller, the Qualified Well Driller who is directly supervising the work should fill in their registration number on their Qualified Well Driller identification card. The Qualified Well Driller signs the form.

## Definitions of Abbreviations

asl.....above sea level	ft.....feet	PID.....Parcel Identifier	USgpm...US gallons per minute
bgl.....below ground level	hrs.....hours	Rg.....Range	UTM.....Universal Transverse
btoc.....below top of casing	in.....inches	Sec.....Section	Mercator Grid
Dia.....Diameter	NAD 83 ..North American	SWL.....static water level	
D.L. ....District Lot	Datum (1983)	Twp.....Township	

## Return Completed Forms to:

Ground Water Data Technician  
 Water Stewardship Division, Ministry of Environment  
 PO Box 9362 Stn Prov Govt  
 Victoria BC V8W 9M2

updated: Jan. 18, 2007



**PRECISION**  
SERVICE & PUMPS INC.  
EST. 1992

1334 RIVERSIDE  
ABBOTSFORD BC  
V2S 8J2

INDUSTRIAL - RESIDENTIAL  
PUMP SUPPLY AND REPAIRS  
PH. 604-850-7010 FX. 604-850-9666

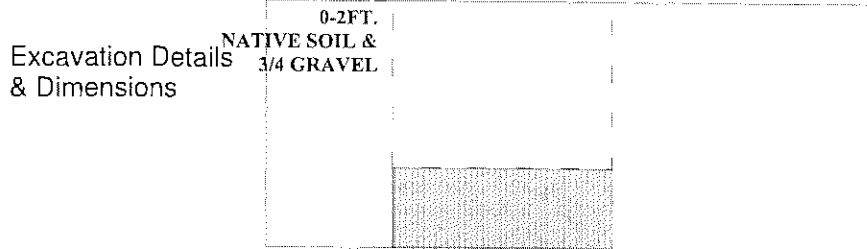
**GPS Location**

UTM Easting or Latitude **N 49° 19.295'**  
UTM Northing or Longitude **W 124° 17.156'**  
Elevation Above Sea Level **111.55 FT.**  
(Datum Ground Level)

Date: **16 JULY 2012**

Barrel Stick Up **1 FT.**

Ground Level



Final  
Top of Barrel **2 FT. BGL**

**Notes:**

2-5.4FT.  
3/8 BENTONITE

Static Water Level **7.15**

5.4-10FT.  
3/4 GRAVEL

**36 IN.** Barrel Diameter

10-17.2FT.  
3/8 BENTONITE

Bottom of Well **17.2 FT.**

CUSTOMER : **NANAIMO REGIONAL DISTRICT**

WELL I. D. : **13714**

LOCATION : **SAN PARIEL**

W. O. NO. : **8224** DWG NO.: **12-8224**



**PRECISION**  
SERVICE & PUMPS INC.  
EST. 1992

1334 RIVERSIDE  
ABBOTSFORD BC  
V2S 8J2

INDUSTRIAL - RESIDENTIAL  
PUMP SUPPLY AND REPAIRS  
PH. 604-850-7010 FX. 604-850-9666

**GPS Location**

UTM Easting or Latitude **N 49° 19.295'**  
UTM Northing or Longitude **W 124° 17.156'**

Date: **16 JULY 2012**

Elevation Above Sea Level **111.55 FT.**  
(Datum Ground Level)

Barrel Stick Up **1 FT.**

Excavation Details  
& Dimensions

**0-1FT.**  
NATIVE SOIL

**1-3FT.**  
3/4 GRAVEL

**3-8.3FT.**  
3/8 BENTONITE

Notes:

**12 IN.** Barrel Diameter

Ground Level

Final  
Top of Barrel **1 FT. BGL**

Static Water Level **7 FT.**

Bottom of Well **8.3 FT.**

CUSTOMER : **NANAIMO REGIONAL DISTRICT**  
LOCATION : **SAN PARIEL**

WELL I. D. :  
W. O. NO. : **8224** DWG NO. : **12-8224**



**PRECISION**  
SERVICE & PUMPS INC.  
EST 1992

1334 RIVERSIDE  
ABBOTSFORD BC  
V2S 8J2

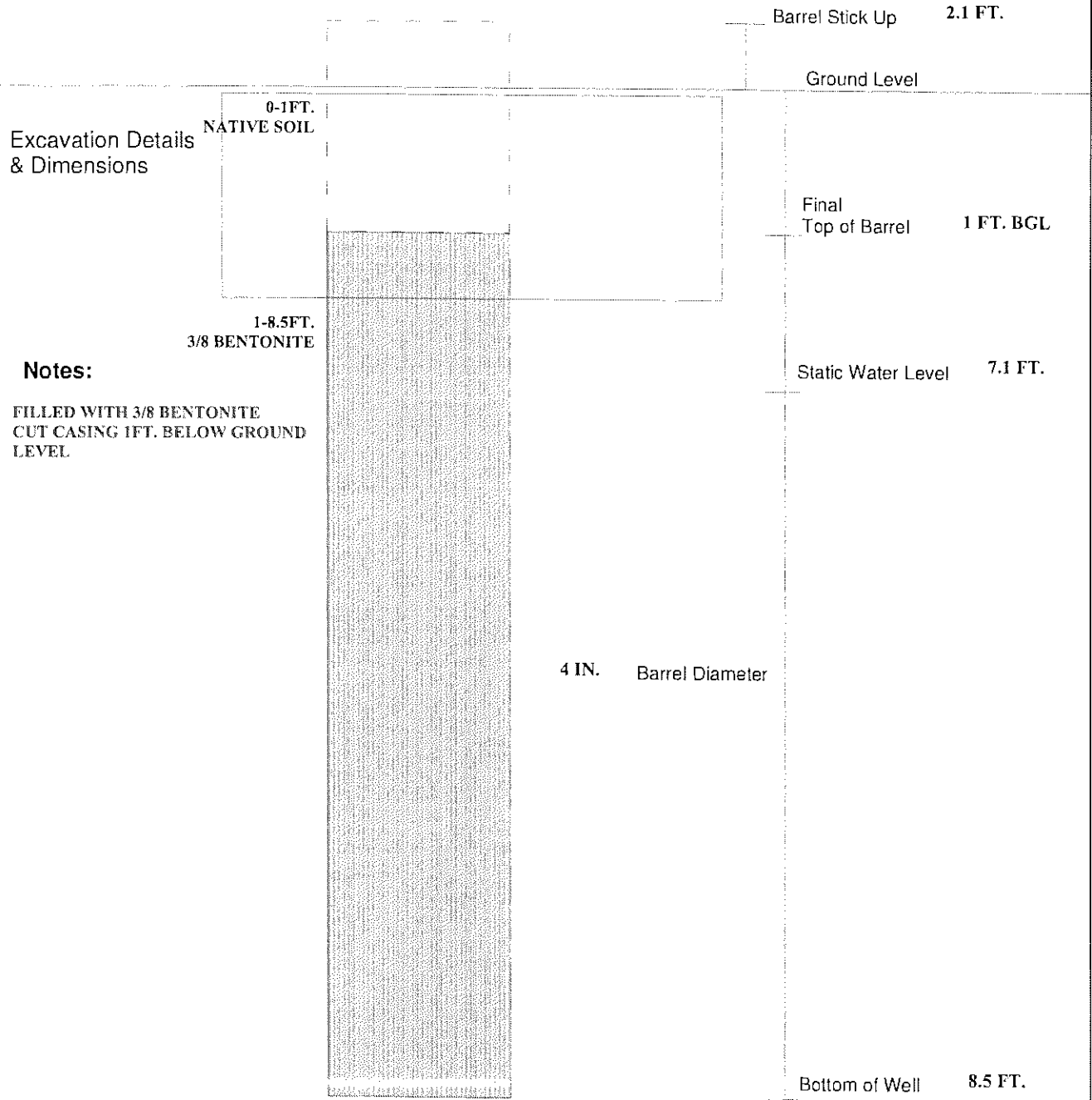
INDUSTRIAL - RESIDENTIAL  
PUMP SUPPLY AND REPAIRS  
PH. 604-850-7010 FX. 604-850-9666

**GPS Location**

UTM Easting or Latitude N 49° 19.296'  
UTM Northing or Longitude W 124° 17.128'

Date: 16 JULY 2012

Elevation Above Sea Level 108.27 FT.  
(Datum Ground Level)



Excavation Details  
& Dimensions

**Notes:**

FILLED WITH 3/8 BENTONITE  
CUT CASING 1FT. BELOW GROUND  
LEVEL

CUSTOMER : NANAIMO REGIONAL DISTRICT  
LOCATION : SAN PARIEL

WELL I. D. :  
W. O. NO. : 8224  
DWG NO. : 12-8224



**PRECISION**  
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PUMP SUPPLY AND REPAIRS  
PH. 604-850-7010 FX. 604-850-9666

**GPS Location**

UTM Easting or Latitude N 49° 19.296'  
UTM Northing or Longitude W 124° 17.128'

Date: 16 JULY 2012

Elevation Above Sea Level 111.55 FT.  
(Datum Ground Level)

Barrel Stick Up 2.4 FT.

Excavation Details  
& Dimensions

0-1FT.  
NATIVE SOIL

1-8.6 FT.  
3/8 BENTONITE

**Notes:**

CUT CASING 1 FT. BELOW  
GROUND LEVEL

Ground Level

Final  
Top of Barrel 1 FT. BGL

Static Water Level 7 FT.

4 IN. Barrel Diameter

Bottom of Well 8.6 FT.

CUSTOMER : NANAIMO REGIONAL DISTRICT

WELL I. D. :

LOCATION : SAN PARIEL

W. O. NO. : 8224

DWG NO. : 12-8224