Vernon - Kamloops

Groundwater Consulting Ltd.

Water Supply and Environmental Assessments

|                            | WELL #1 (LOT#1) - WTN 83092, 82E041222#1                                |
|----------------------------|---|
| July 31, 2001              | WELL#2 (LOT 2)-MTN 83093, 82E041222#2                                   |
| Regional Distric           | ct of Okanagan-Similkameen WELL #3(LoT3) - WTN 82501, 82E041224 #2      |
| 101 Martin Stre            | WELL #4(1074)-WTN 87094, 87 FOUI 224#2                                  |
| Penticton, B.C.<br>V2A 5J9 | WELL #6(LOT 6)-WTN 82499, 82E041224=1                                   |
|                            | WELL#7(LOT 7)-WTN 82500,82E042 113#2                                    |
| Attention:                 | Roza Aylwin, Planning Technician WELL #8(LOT 8)-WTN 82498, 82E042113 #1 |
| Dear Sirs:                 |   |

# Re: Water Supply Evaluation – Proposed Subdivision of D.L. 1799, Except Plans 14698, 39281 and H 11033, O.D.Y.D. – Apex Mtn Area

## 1.0 Introduction

The present investigation has been carried out at the request of Mr. Karl Neff to assess the capacity and water quality of a series of recently drilled water wells, completed as a source of potable water for the proposed subdivision described herein, and to establish possible effects by utilizing the available groundwater resources to neighboring water wells. Water samples were also obtained from two creek sources, which flow through the property. It is currently planned to subdivide the property into ten lots as shown on the attached subdivision plan (Figure 1). Potable water for the subdivision will be obtained from seven (7) water wells and two (2) surface water sources.

Our investigation has been carried out in pursuant to the **RDOS** Subdivision Servicing Bylaw No. 1567 for quantity and water quality. The investigation has involved a site inspection and a review of existing available information including a surficial geology and bedrock geology report, a topographic map and driller's reports of existing water wells on file with the B.C. Ministry of Environment, Lands and Parks (*MoELP*). In addition, *Kala* has reviewed the driller's reports for the seven new water wells completed on the property, and has provided on-site supervision of the pumping test program, which was recently conducted to evaluate a safe yield for each of the seven new water wells.

#3 - 3107A - 31st Avenue, Vernon, B.C. V1T 2G9. Tel: (250) 545-1720 Fax: (250) 545-1720 E-mail: Kalapal@mindlink.net
 #207 - 220 4th Avenue, Kamloops, B.C. V2C 3N6. Tel: (250) 372-9194 Fax: (250) 372-9398 E-mail: Kalapac@kamloops.net

## 2.0 Background

## 2.1 Site Description

The property is located approximately 22 kilometres south and west of the City of Penticton, along Green Mountain Road. More specifically, it is located at the junction of Green Mountain Road and the turn-off to Apex Mountain Ski resort. The topographic situation for the proposed subdivision is valley side for the north part and valley bottom for the south portion. Drainage is provided by two creeks, including Clark Creek which flows southward through Lot 5 of the proposed subdivision, and Shafford, which flows eastward through proposed Lots 2, 3, 4, 5, 9, and 10.

#### 2.2 Geology

#### 2.2.1 Surficial Geology

The surficial material occurring over that portion of the development located on the north side of Green Mountain Road is comprised of a thin mantle of glacial moraine (till) overlying bedrock. Along the lower part of the property, near Shafford Creek the surficial material is comprised of alluvial sand and gravel with thin layers of silt and/or clay. The alluvial deposits in this area range up to approximately 75 feet in depth.

#### 2.3.2 Bedrock Geology

The local bedrock material (see Figure 2) has been designated by the BC Geological Survey (BCGS) as volcanic rocks of Triassic age occurring north of Green Mountain Road and comprised of greenstone and grey chert. South of Green Mountain Road the bedrock strata is comprised (BCGS) of sedimentary rocks, also of Triassic age and comprised of dark chert and argillite. There does not appear to be any major structural zones such as faulting in the local area.



# 3.0 Existing Water Wells

As previously noted in this report, there are seven (7) newly constructed water wells on the property, which have been completed into either the bedrock strata or in alluvial sands and gravels, depending on the topographic situation. In addition to the water wells it is currently proposed to use two surface water sources, namely Clark and Shafford Creek to supply the remaining three (3) lots. A summary of the existing water wells is shown in Table 1 below:

| Table 1 – Summary of Existing Water Wells |             |                                     |                                       |                             |  |
|---|-------------|-------------------------------------|---------------------------------------|-----------------------------|--|
| Lot/Well Number                           | Total Depth | Aquifer Description                 | Nature of<br>Completion               | Driller's Reported<br>Yield |  |
| Lot 1 – Well #1                           | 57 feet     | Sand & Gravel                       | Well screen 53-57'                    | 50 Plus USgpm               |  |
| Lot 2 – Well #2                           | 55 feet     | Sand & gravel, some clay            | Open hole at 55 ft.                   | 25 – 30 USgpm               |  |
| Lot 3 – Well #3                           | 59 feet     | Gravel with clay and silt stringers | Perforated 4 ½ "<br>PVC pipe          | 10 – 20 USgpm               |  |
| Lot 4 – Well #4                           | 57 feet     | Gravel                              | Well screen 53-57'                    | 8 USgpm                     |  |
| Lot 6 – Well #6                           | 215 feet    | Bedrock                             | Open hole and liner<br>16 to 215 feet | 3.5 USgpm                   |  |
| Lot 7 – Well #7                           | 305 feet    | Bedrock                             | Open hole and liner<br>34 to 305 feet | 5 – 7 USgpm                 |  |
| Lot 8 – Well #8                           | 302 feet    | Bedrock                             | Open hole and liner<br>14 to 302 feet | 15 – 20 USgpm               |  |

A detailed driller's report for each well is attached to Appendix B of this report.

## 4.0 Water Supply Evaluation

In order to establish the safe, long-term yield for the proposed sources of water supply, a 24-hour pumping test was conducted with each well under the supervision of *Kala*. All testing services were provided by Superior Pumps of Vernon, B.C. In each case the well was pumped at a constant rate, with only some minor variations as required, for the test duration and water level drawdown was measured using an electric well sounder. Discharge rates were monitored using a pre-calibrated container and stop watch. Results of the testing program have been tabulated and plotted on semi-log graphs of drawdown versus time (see Appendix C). A summary of the results is shown in Table 2 on the following page.

| Table 2 – Summary of Pumping Test Results |                      |                            |                             |                              |  |
|---|----------------------|----------------------------|-----------------------------|------------------------------|--|
| Well/Lot<br>Number                        | Ave. Pumping<br>Rate | Drawdown at<br>End of Test | Total Available<br>Drawdown | Projected Safe<br>Well Yield |  |
| Lot 1 – Well #1                           | 8.0 Igpm             | 3.6 feet                   | 49.0 feet                   | 30 plus Igpm                 |  |
| Lot 2 – Well #2                           | 7.0 Igpm             | 2.3 feet                   | 24.0 feet                   | 15.0 Igpm                    |  |
| Lot 3 – Well #3                           | 3.75 Igpm            | 21.8 feet                  | 33.4 feet                   | 6.0 Igpm                     |  |
| Lot 4 – Well #4                           | 7.0 Igpm             | 1.0 feet                   | 46.4 feet                   | 8.0 Igpm                     |  |
| Lot 6 – Well #6                           | 2.5 Igpm             | 72.7 feet                  | 150 feet                    | 2.5 Igpm                     |  |
| Lot 7 – Well #7                           | 7.0 Igpm             | 77.26 feet                 | 170 feet                    | 6.0 Igpm                     |  |
| Lot 8 – Well #8                           | 5.0 Igpm             | 141.5 feet                 | 191 feet                    | 6.0 Igpm                     |  |

Based on the results of the testing program, the safe, long-term yield for each of the existing water wells exceeds the requirements of the *RDOS* Subdivision Servicing Bylaw No. 1567, which specifies that a source of water must be available on each parcel capable of providing not less than 13,600 litres per day. This converts to a sustainable yield of 2.1 Igpm for each well.

# 5.0 Water Quality

A copy of the certificate of Analysis for each well and the two surface water sources (Clark and Shafford Creeks) is attached to Appendix D of this report. Based on an evaluation of the results and with only a few minor exceptions, the water quality meets the "*Guidelines for Canadian Drinking Water Quality*" for all of the existing water wells. The minor exception relates to the total coliform identified in Well No. 2 (320 colonies/100 mL) and to the background coliform detected in Well No. 4. Shock chlorination applied to each of these two wells will alleviate the problem.

Each of the two creek samples also showed the presence of total coliform and in the case of Shafford Creek, fecal coliform. It is *Kala*'s present understanding that chlorination is not mandatory for an individual residence obtaining water from a surface water source, but because this is surface water, we would recommend that some form of filtration and chlorination be used for each of the proposed surface water sources, currently proposed for Lots 5, 9 and 10.



## 6.0 Summary

In summary it is *Kala*'s opinion that there is an adequate supply of water from each of the seven (7) newly constructed water wells on the property to meet the yield requirements of *RDOS* Subdivision Servicing Bylaw No. 1567. With only some very minor exceptions, the water quality meets the "*Guidelines for Canadian Drinking Water Quality*" for all of the existing water wells. The minor exception relates to the total coliform identified in Well No. 2 (320 colonies/100 mg) and to the background coliform detected in Well No. 4. Shock chlorination applied to each of these two wells will alleviate the problem. Each of the two creek samples also showed the presence of total coliform and in the case of Shafford Creek, fecal coliform. *Kala* recommends that some form of filtration and chlorination be used for each of the proposed surface water sources, currently proposed for Lots 5, 9 and 10. Finally, it is *Kala*'s opinion that groundwater development on the proposed subdivision will have minimal effects to surrounding neighboring water wells and adjoining wells on the subdivision, providing the water is used for the purpose of domestic requirements only and not large scale irrigation watering.

## 6.0 Closure

This report was prepared in accordance with generally accept groundwater potential evaluation presented within this repor information and a site reconnaissance, but does not preclude formations not identified. The availability and potential of a grc if additional information becomes available Kala Groundwater C opportunity to review such material and verify the conclusions guarantee explicitly or implicitly any reported well yields, as the

Chrio: Please review and advies whether we will require a covenant for Lots 2, 4, 5, 9:10? "minor enceptions" choliforn lovels. Roza.

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contractors and also on the various methods used by drilling contractors and individuals to determine well yield.

The applicability of this report is only valid to the extent that there has been no material alteration from any of the said descriptions provided to *Kala*, unless *Kala* is specifically requested by the client to review and

revise this report in light of such alterations. This report must be used in its entirety. Statements of professional opinion are those of **Kala**. If additional information or assessment findings arise which may alter the conclusions and / or recommendations of this report **Kala** would be pleased to review and append our report where required.

We trust this meets your present requirements and if there are any questions, please do not hesitate to contact the undersigned.

Yours truly, Kala Groundwater Consulting Ltd.

L.C. Topp, P. Geo. Hydrogeologist

LCT/it Encl:

c.c. Karl Neff



# APPENDIX A

**Report Figures** 





Roads 1:20K (<100K) Rivers 1:20K (<100K)

Border line 1:250K (<2M)

ology Layers

Volcanic rocks - GSB 1:250K (<1M) Cenozoic volcanic rocks Mesozoic volcanic rocks

Paleozoic volcanic rocks Proterozoic volcanic rocks Unknown

# Sedimentary rocks - GSB 1:250K (<1M)

Cenozoic sedimentary rocks Mesozoic sedimentary rocks Paleozoic sedimentary rocks Proterozoic sedimentary rocks Unknown

# Metamorphic rocks - GSB 1:250K (<1M)

500

METERS

Cenozoic metamorphic rocks Mesozoic metamorphic rocks Paleozoic metamorphic rocks

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KALA GROUNDWATER CONSULTING LIMITED

# **BC Geology Legend Report**

| Map Code:     | uTri   |
|---------------|--|
| AGE:          | TRIASSIC   |
| FORMATION:    | INDEPENDENCE   |
| Description:  | GREENSTONE, SEDIMENTS, GREY CHERT                                    |
| DIGITAL CODE: | 173105742  |
|               |  |
| AUTHOR:       | T. Hoy, A. Legun, B.N. Church, G. Gibson, K. Glover and J.O. Wheeler |
| TITLE:        | Open File 1994-8 Geology of the Kootnay River Map-Area               |

British Columbia Geological Survey Branch B.C. Ministry of Energy and Mines

# **BC Geology Legend Report**

| Map Code:     | Trsm   |
|---------------|--|
| AGE:          | (PERMO?) TRIASSIC  |
| FORMATION:    | SHOEMAKER  |
| Description:  | DARK CHERT, ARGILLITE  |
| DIGITAL CODE: | 173001142  |
|               |  |
| AUTHOR:       | T. Hoy, A. Legun, B.N. Church, G. Gibson, K. Glover and J.O. Wheeler |
| TITLE:        | Open File 1994-8 Geology of the Kootnay River Map-Area               |

British Columbia Geological Survey Branch B.C. Ministry of Energy and Mines

# APPENDIX B

Driller's Reports for Existing Water Wells

LL DRILLING LOG

| Lat III at   |  |               |                           |
|--|--|---------------|---------------------------|
| Name of Contractor STeves Drilli   | r g  |               |                           |
| Date July 3/01   | 521  | Thread<br>0.0 | led cap<br>ft. = datum    |
| Total depth of well in feet 59   |  |               | = average<br>ground level |
| Depth of well casing 53  | Vertical Scale                                       |               | Clary +                   |
| Static water level in feet44   | $l'' = \underline{/O} ft.$                           |               | Graven                    |
| Inside dia. of well casing   | NOTE:  |               |                           |
| Type of Well casing <u>Steel</u>   | • Concrete slab<br>only if spec-                     |               | 18-52                     |
| Test Apparatus (Pump or bailer)  | ified.   |               | Glacial                   |
| Pump.  |  |               | Fill<br>Grey.             |
| Test Capacity in G.P. Mar 50 Imp/65  | Indicate water-                                      |               |                           |
| Time of Pumping test in hours $2$ .<br>Total drawdown in feet $10$   | bearing strata<br>52 <sup>'</sup> To 57 <sup>'</sup> |               | types                     |
| Time in hours required for well to<br>recover from drawdown to static level  | ieen Set   |               |                           |
|  | 510+ 25  | -             | S<br>S                    |
| WELL DRILLER'S RECOMMENDATIONS   |  |               | or                        |
| 50 feet  |  |               | 52 Gravel +<br>7 Sand     |
| Recommend Operating Capacity of Well   | of casing 53   |               | Ester bearin              |
| US gals./hr.*  |  |               | dock                      |
| WELL LOG   |  |               |                           |
| On the right hand side of the sketch of<br>well casing, indicate soils, gravel, sand,<br>etc., encountered, and the depth. | Indicate bottom<br>of hole 57                        | -<br>-<br>-   |                           |



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| Drilling Log for Well at  | ······                            | ·····  |                           |
|---|-----------------------------------|--------|---------------------------|
| LotZ  |                                   |        |                           |
|   | С.,                               |        |                           |
| Name of Contractor <u>2/eues</u> Duilli   | <i>Hq</i>                         | Threa  | ded_cap                   |
| Date June 28/01   | 121                               | 0.0    | ft. = datum               |
| Tatal dopth of wall in fact 55  | Ψ. ~                              |        | = average<br>ground_level |
|   |                                   |        | 0-18'                     |
| Depth of well casing 53   | Vertical Scale                    | -      | Clay +                    |
| Static water level in feet $34$   | $l'' = \frac{10}{10} \text{ ft.}$ | E      | Gravel.                   |
| Inside dia. of well casing  |                                   | -      |                           |
| Type of Well casing <u>Steel</u>  | NOTE:<br>• Concrete slab          | F      |                           |
| CAPACITY TEST   | ified.                            |        | 18-35'                    |
| Test Apparatus (Pump or bailer)   |                                   | -      | Brown Clay.               |
| Pump.   |                                   | F      |                           |
| Test Capacity in G.P. HM _ 30 _ Lmp/US*   |                                   | -      |                           |
| Time of Pumping test in hours $2$   | Indicate water-<br>bearing strata | FI     |                           |
| Total drawdown in feet 6  | 35 to 55 FF                       |        |                           |
| Time in hours required for well to  |                                   | -      |                           |
| recover from drawdown to static level   |                                   |        | - Sand.                   |
| -<br>   |                                   | -      | ion / Clay                |
| WELL DRILLER'S RECOMMENDATIONS  |                                   |        |                           |
| Depth of Pump Suction Setting   |                                   | -      | or                        |
| 50' foot  |                                   | -      |                           |
| Leel  | Indicate bottom                   | -      | g                         |
| Recommend Operating Capacity of Well  | of casing 55                      | -      | 6<br>                     |
| US gals./hr.*   |                                   |        |                           |
|   |                                   |        | Rock                      |
| WELL LOG  |                                   | -      |                           |
| On the right hand side of the sketch of   | Indicate bottom                   |        |                           |
| well casing, indicate soils, gravel, sand,<br>etc., encountered, and the depth. | of hole 55                        |        |                           |
|   |                                   |        |                           |
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| - 1749 Sub: La  | <del>&lt; 13</del>   |
| Descriptive Locotian  |  |
| 1, TYPE 1 D New Well 2 C Reconditioned  | 9. CASING: 1 Sieet 2 Galvanized 3 Wood   |
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| 3 WATER 1 Domestic 2 Municipal 3 Dirication   | from D ft  |
| WELL USE4 Comm. & Ind. Criher   | 10 <b>54</b> tt  |
| 4. DRILLING ADDITIVES   | Thickness 72 P ins   |
| 5. MEASUREMENTS from 1 Diground level 2 D top of casing   | Bitlars unit tt 1 □ shove 2 î l below ground level   |
| casing height above ground level R.   | 1 Weided 2 Camented 3 Threaded 1 DNew 2 Used   |
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| 0 4 etter   | Shae (s) :   |
| 4 12 typen withled selle  | Open hole, from to ft Diameter ins   |
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| 48 50 hard you flash  | IO. SUNEEN: UNaminal (Telescope) ≤ LIP:pe Size<br>Type 1 □ Continuous Sunt 2 □ Perforated 3 □ Lauvra |
| 10 59 voured religid with   | Other  |
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|   | Length / // t  |
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|   | from the ft  |
|   | ta ft  |
|   | Fittings, topbottom  |
|   | IL DEVELOPED, BY: 1 Clausing 2 Clausing 3 Right  |
|   | 4 Bailing 5 D Pumping D Other  |
|   | 12. TEST 1 D Pump 2 Deall 3 () Air Date Colored  |
|   | Rote 10 USgpm Temp 51 °C SWL before test 3-1 ft  |
|   |  |
|   | mins WL mins WL mins WL mins WL  |
|   |  |
|   |  |
|   | 3 ACCOMMENCED OLAND STITE TRECOMMENDED DUM OFTENDER RECOMMENDED DUMAN PATEL                          |
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|   | 15 WATER ANALYSIS: 1 Hordness         Impa   |
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| Address   | 4 pH   |
| B. WELL LOCATION SKETCH   | Lab Dote Lage J. Jan Dote Lage J.  |
| Co RA 1/ IB. FINAL  | WELL COMPLETION DATA   |
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| Gr GA A A ST X Well Head  | Completion draw ct cap   |
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|--|-----------------------------------|-----|-------------------------------------|
| LL DRILLING LOC  |                                   |     |                                     |
| Drilling Log for Well at   |                                   |     |                                     |
| Name of Contractor   |                                   |     |                                     |
| Date July 6/01   | 2' 7                              | 0.0 | ded cap<br>ft. = datum<br>= average |
| Total depth of well in feet <u>57</u>  | ł                                 |     | ground level                        |
| Depth of well casing53   | Vertical Scale                    |     | Sand                                |
| Static water level in feet <u>6</u>  | $1 - \frac{10}{10}$               |     | Gravel                              |
| Inside dia. of well casing   | NOTE                              |     |                                     |
| Type of Well casing <u>Steel</u>   | * Concrete slab<br>only if spec-  |     |                                     |
| CAPACITY TEST  | ified.                            |     |                                     |
| Test Apparatus (Pump or bailer)  |                                   | -   |                                     |
| Pump   |                                   |     | Sali                                |
| Test Capacity in G.P.H. <u>/8</u> Imp/05*  | Indicate water-                   | -   | sindy                               |
| Time of Pumping test in hours <u>46</u>  | bearing strata                    |     | Slay                                |
| Total drawdown in feet $28$  |                                   |     | tyl                                 |
| Time in hours required for well to recover from drawdown to static level   |                                   | -   | 7                                   |
| <u> </u>   |                                   | -   | ios                                 |
| WELL DRILLER'S RECOMMENDATIONS   |                                   | -   |                                     |
| Depth of Pump Suction Setting  | Casing<br>Botton                  |     | wator                               |
| <u> </u>   | Indicate bottom                   | -   | Gravel                              |
| Recommend Operating Capacity of Well   | of casing                         |     | Due Clay                            |
| <u>US gals./hr.*</u>   | Berton                            | -   | Bedrock                             |
|  | of Scieen                         |     | RO                                  |
| WELL LUG   |                                   | -   |                                     |
| On the right hand side of the sketch of<br>well casing, indicate soils, gravel, sand,<br>etc., encountered, and the depth. | <b>Indicate</b> bottom<br>of hole |     |                                     |

| 0//1//01 14/10 KOINE FERMOE MEDIDHUK ~  | 200 040 1(20 NO.200 F004/00)  |
|---|---|
| Province of Britist bia Ministry of Envir   | onment Water Management   |
| WATER WE  | LL RECORD   |
| N T S MAP   |   |
| Owners Name & Address _ 17.97 Saun 1904   | Pl Sh 6/Rel Doug Wellen Loggy   |
| Legal Description & Address   |   |
| Descriptive Location  | WTN 82.499  |
| A, TYPE 1 Prew Well 2 D Reconditioned<br>OF WORK 3 D Deepened 4 D Abandanad                 | 9. CASING: 1 Steel 2 Galvanized 3 DWood<br>Materials 4 Brelastic 5 D Concrete   |
| 2. WORK 1 Cable tool 2 Bored 3 Letted<br>METHOD 4 Rotory a Cmud b Cair c Creverse<br>Dother | Diameter / - ins  |
| 3. WATER 1 Domestic 2 Diffunction   | from Q ft   |
| 4. DRILLING ADDITIVES   | Thickness 520'  |
| 5. MEASUREMENTS from 1 ground level 2 D top of cosing                                       | Pitless unitft 1 © obove 2 [] below ground level  |
| Casing height above ground level n.   | 1 Welded 2 Comented 3 Threaded 1 New 2 Used   |
| 6 12 overfurden   | Shoe (s)  |
| 12 2 15 klich   | Open hole, from to ft Olameter ins  |
|   | IO. SCREEN: 1 Dimominal (Telascope) 2 Dipipe Size   |
|   | Type 1 Continuous Stol 2 Perforated 3 Cuburre   |
|   | Materiol 1 🗇 Stainlass Steel 2 🗆 Plastic 🔤 Other<br>Set from to ft below ground level   |
| <b>y</b> <sup>*</sup>   | RISER, SCREEN & PLANKS  |
|   | Langth #<br>Diem 10 11 Option Ins   |
|   | Slot Size 7 7 0 - 2 5 - ine<br>from fr  |
|   | To ti   |
|   | Gravel Pack   |
|   | II. DEVELOPED BY: 1 🗆 Surging 2 🗆 Jerning 3 🗗 Air<br>4 🖸 Bolling 5 🖸 Pumping 🗍 Other  |
|   | 12. TEST 1 [] Pump 2 [] Bail 3 [] Ar Date 2 [] Contraction 1  |
|   | Weier Level   |
|   | ORAWOOWN in ft     DRAWOOWN in ft     DRAWOOWN in ft     DRAWOOWN in ft     DRAWOOWN in ft     WL     mins     WL     mins     WL     mins     WL     mins     WL |
|   |   |
|   |   |
|   | 13. end 210 + 3-4 User  |
|   | 14. WATER TYPE: 1 Defresh 2 Declar 3 Delear 4 Deloudy<br>colour colour; gos 1 Dyst 2 Dno  |
|   | 15. WATER ANALYSIS: 1 Hardness  |
| Address   | 2 Iron Line Ingr 3 Chloride Line Ingr Ingr 4 pH Line Line Field Cote Line Ingr 1  |
| 8. WELL LOCATION SKETCH   | E I D No C  |
| IG. FINAL   | WELL COMPLETION DATA  |
| Static Wa   | ler Levelff Four US gpm Head  |
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| Owners Name & Address   | 6-lat 7  |
| Descriptive Location  |  |
| I. TYPE 1 Wew Well 2 GReconditione<br>OF WORK 3 Geepend 4 G Abandoned                 | d 9. CASING: 1 Datest 2 DiGolvanized 3 D Wood<br>Materiale 4 D Plastic 5 D Concrete kr   |
| 2. WORK 1 Cable tool 2 D Bared 3 D Jetted<br>METHOD 4 B Rotary a Dmud b Pair s Drever | Alera units  |
| 3. WATER 1 @ Comestic 2 [] Municipal 3 [] Irrigat                                     | Diameter 6 2 3 5 ins   |
| 4. ORILLING ADDITIVES   | Thickness 320 Ins  |
| 5. MEASUREMENTS from 1 Degrand level 2 top of ca                                      | sting Pitless unltft 1 ( above 2 () below ground level   |
| FROM TO 6. WELL LOG DESCRIPTION   | SWL Perforations:  |
| 0 34 overburden   | Shoe (s) :   |
|   | Grout:   |
|   | 10, SCREEN = 1 D Nominel (Telescope) 2 D Pipe Size<br>Type 1 D Continuous Stot 2 D Perforated 3 D Louvre   |
|   | Manarial 1 Dither  |
|   | RISER, SCREEN & BLANKS   |
|   | $\frac{\text{Length}}{\text{Diam. 1D}} = \frac{H}{O} = \frac{240}{3}$  |
|   | Stot Size fina fram  |
|   | fo   |
|   | Gravel Pack  |
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|   | 15. WATER ANALYSIS: 1 Hardness   |
| Address   |  |
| B.WELL LOCATION SKETCH  | SITE I D No 7 Lob Date Land de log   |
| 16. FIN   | NAL WELL COMPLETION DATA   |
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| 17. DR  | ILLER STAFWART STATE   |
| GRM. MIT.   | Signature _ 7. Merrint   |
| 18. COL<br>Adr  | MTRACTOR. KOBAH MTN ORILLING CO  |
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| Legal Description & Address & 1299 Sub Lat   | 2 (cight)   |         |
| Descriptive Location   |   |         |
| I. TYPE 1 PNew Well 2 C Reconditioned<br>GF WORK 3 Deepened 4 D Abandoned                | 9. CASING: 1 Disne: 2 Disatvonized 3 DWaod<br>Materials 4 DPPlastic 5 Diconcrete              |         |
| 2. WORK 1 Cable tool 2 C Bored 3 D Jetted<br>METHOD 4 B Rotary a Dmud b Drain c Draverse | Digenter units  |         |
| 3. WATER 1 Damestic 2 1 Municipal 3 Warigation   | Diameter 5 5 11 Ins<br>from O fi  |         |
| 4. DRILLING ADDITIVES  | to 19 302 ft<br>Thickness 32 0 ins  |         |
| 5. MEASUREMENTS from 1 ground level 2 0 top of casing                                    | Weight 60 Ib/It   |         |
| Casing height above ground lavel N.  | 1 Q Welded 2 E Cemented 3 D Threaded 1 D New 2 D Used   |         |
| 0 8 orgebunden   | Shoe (s):   |         |
| 8 302 busilt   | Open hois, from to ft Olameter ins  |         |
|  | IO. SCREEN: 1 Diversinal (Telescope) 2 Dige Size  |         |
|  | Type 1 Continuous Slot 2 BPerforated 3 CLouvre  |         |
|  | Material 1 🛛 Stainless Steet 2 BrBlastic 🛛 Other<br>Set fram 223 to 322 ft below ground level |         |
|  | AISER, SCREEN & BLANKS Units  |         |
|  | Diam. 10 44 Finen ine   |         |
|  | fram 11   | ,       |
|  | Fittings, topbottom   |         |
|  | II. DEVELOPED BY: 1 Dsurging 2 Duetting 3 Brain   |         |
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|  | 13. ASCOMETROED FURT TYRE SECONDERROED PLACE PYTHIN RECOMMENDED FURT                          |         |
|  | 14. WATER TYPE: 1 Bothesh 2 Datily 3 OBCless 4 Octoury  |         |
| 7 CONSULTANT   | IS. WATER ANALYSIS: 1 Hardness  |         |
| Address  | 2 ron 1 1 mg/L 3 Charide 1 1 mg/L   |         |
| 8. WELL LOCATION SKETCH  |   |         |
| IG. FINAL W  | ELL COMPLETION DATA   |         |
| 7 8 Static Water   | r Levelft formUS gpm readerft   |         |
| Back filled<br>Watt Head   | Completion C.A.P  |         |
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# APPENDIX C

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# Pumping Test Data

Well No. 1



Karl Neff

# PUMPTEST (Drawdown)

Water Supply Evaluation - Karl Neff Lot 1 - Well No. 1

Date test started: July 4th, 2001 Time test started: 6:30 AM Ave. pumping rate: 8 Igpm Pre-test water level: 4.25 metres Reference Point: Top of casing Height of ref. point: 0.68 metres above grade Depth of well: 17.37 metres (57 feet) Screen Interval: 16.15 to 17.37 metres

| Time (t) since<br>pumping started     | Depth to<br>water in | Drawdown<br>in | Comments               |
|---------------------------------------|----------------------|----------------|------------------------|
| in minutes                            | metres               | metres         |                        |
| 0                                     | 4.25                 | 0.00           | <u></u>                |
| 1                                     | 5.35                 | 1.10           |                        |
| 2                                     | 5.36                 | 1.11           | Pumping rate: 8 Igpm   |
| 3                                     | 5.40                 | 1.15           |                        |
| 4                                     | 5.41                 | 1.16           |                        |
| 6                                     | 5.41                 | 1.16           |                        |
| 8                                     | 5.40                 | 1.15           |                        |
| 10                                    | 5.41                 | 1.16           |                        |
| 13                                    | 5.42                 | 1.17           |                        |
| 16                                    | 5.410                | 1.16           |                        |
| 20                                    | 5.410                | 1.16           |                        |
| 25                                    | 5.410                | 1.16           |                        |
| 32                                    | 5.41                 | 1.16           |                        |
| 40                                    | 5.41                 | 1.16           |                        |
| 50                                    | 5.41                 | 1.16           |                        |
| 64                                    | 5.40                 | 1.15           | Pumping rate: 8 Igpm   |
| 80                                    | 5.42                 | 1.17           |                        |
| 100                                   | 5.41                 | 1.16           |                        |
| 120                                   | 5.40                 | 1.15           |                        |
| 150                                   | 5.40                 | 1.15           |                        |
| 190                                   | 5.41                 | 1.16           |                        |
| 240                                   | 5.41                 | 1.16           |                        |
|                                       | 5.41                 | 1.16           |                        |
| 380                                   | 5.41                 | 1.16           |                        |
| 480                                   | 5.44                 | 1.19           |                        |
| 600                                   | 5.35                 | 1.10           | Pumping rate: 8.0 igpm |
| /80                                   | 5.31                 | 1.06           |                        |
| 960                                   | 5.31                 | 1.06           |                        |
| 1200                                  | 5.31                 | 1.06           | Pumping rate: 8.0 igpm |
| 1440                                  | 5.35                 | 1.10           | Ubtain water samples   |
|                                       |                      |                |                        |
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# PUMPTEST (Drawdown)

Water Supply Evaluation - Karl Neff Lot 2 - Well No. 2

Date test started: July 3rd, 2001 Time test started: 2:00 PM AM Ave. pumping rate: 7 Igpm Pre-test water level: 8.75 metres Reference Point: Top of casing Height of ref. point: 0.54 metres above grade Depth of well: 16.76 metres (55 feet) Screen Interval: Open Hole at 16.75 metres

| Time (t) since<br>pumping started | Depth to<br>water in | Drawdown<br>in | Comments                              |
|-----------------------------------|----------------------|----------------|---------------------------------------|
| in minutes                        | metres               | metres         |                                       |
| 0                                 | 8.75                 | 0.00           |                                       |
| 1                                 | 9.28                 | 0.53           |                                       |
| 2                                 | 9.34                 | 0.59           | Pumping rate: / Igpm                  |
| 3                                 | 9.35                 | 0.60           |                                       |
| 4                                 | 9.355                | 0.61           |                                       |
| 0                                 | 9.303                | 0.62           |                                       |
|                                   | 9.37                 | 0.62           |                                       |
| 10                                | 9.37                 | 0.62           |                                       |
| 15                                | 9.30                 | 0.03           |                                       |
| 10                                | 9.30                 | 0.03           |                                       |
| 20                                | <u> </u>             | 0.03           |                                       |
| 32                                | 9.38                 | 0.03           |                                       |
| 40                                | 9,39                 | 0.64           |                                       |
| 50                                | 9.38                 | 0.63           |                                       |
| 64                                | 9.38                 | 0.63           | Pumping rate: 7 lgom                  |
| 80                                | 9.39                 | 0.64           |                                       |
| 100                               | 9.39                 | 0.64           |                                       |
| 120                               | 9.39                 | 0.64           |                                       |
| 150                               | 9.41                 | 0.66           |                                       |
| 190                               | 9.42                 | 0.67           |                                       |
| 240                               | 9.44                 | 0.69           |                                       |
| 300                               | 9.44                 | 0.69           |                                       |
| 380                               | 9.43                 | 0.68           |                                       |
| 480                               | 9.44                 | 0.69           |                                       |
| 600                               | 9.44                 | 0.69           | Pumping rate: 7.0 Igpm                |
| 780                               | 9.38                 | 0.63           |                                       |
| 960                               | 9.40                 | 0.65           |                                       |
| 1200                              | 9.41                 | 0.66           | Pumping rate: 7.0 Igpm                |
| 1440                              | 9.45                 | 0.70           | Obtain water samples                  |
|                                   |                      |                |                                       |
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Kala Groundwater Consulting Ltd.

Water Supply Evaluation



PUMPTEST (Drawdown)

Water Supply Evaluation - Karl Neff Lot 3 - Well No. 3

Date test started: July 10th, 2001 Time test started: 12:00 Noon Ave. pumping rate: 3.75 Igpm Pre-test water level: 5.51 metres Reference Point: Top of casing Height of ref. point: 0.15 metres above grade Depth of well: 18.0 metres (59 feet) Screen Interval: Perforated liner - 15.5 to 18.0 metres

| Time (t) since<br>pumping started | Depth to<br>water in | Drawdown<br>in | Comments                               |
|-----------------------------------|----------------------|----------------|--|
| in minutes                        | metres               | metres         |  |
| 0                                 | 5.51                 | 0.00           |  |
|                                   | 10.31                | 10.80          | Dumning rota 6 Ignm                    |
|                                   | 10.32                | 10.81          | Pumping rate: 6 igpm                   |
| 3                                 | 16.20                | 10.75          |  |
| 4                                 | 16.240               | 10.73          |  |
| 8                                 | 16.230               | 10.74          |  |
| 10                                | 16.24                | 10.73          |  |
| 13                                | 16.25                | 10.74          | · · · · · · · · · · · · · · · · · · ·  |
| 16                                | 16.23                | 10.74          | ······································ |
| 20                                | 16.25                | 10.74          |  |
| 25                                | 16.25                | 10.74          |  |
| 32                                | 16.22                | 10.71          |  |
| 40                                | 16.23                | 10.72          |  |
| 50                                | 16.25                | 10.74          |  |
| 64                                | 16.26                | 10.75          | Pumping rate: 6 Igpm                   |
| 80                                | 16.25                | 10.74          |  |
| 100                               | 16.24                | 10.73          |  |
| 120                               | 16.28                | 10.77          |  |
| 150                               | 16.30                | 10.79          |  |
| 190                               | 16.33                | 10.82          |  |
| 240                               | 16.34                | 10.83          | Decrease rate to 3.75 Igpm             |
|                                   | 15.57                | 10.06          |  |
| 380                               | 14.23                | 8.72           |  |
| 480                               | 12.19                | 6.68           |  |
| 600                               | 12.20                | 6.69           | Pumping rate: 3.75 Igpm                |
| 780                               | 12.22                | 6.71           |  |
| 960                               | 12.23                | 6.72           |  |
| 1200                              | 12.23                | 6.72           | Pumping rate: 3.75 lgpm                |
| 1440                              | 12.15                | 6.64           | Obtain water samples                   |
|                                   |                      |                |  |
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Water Supply Evaluation

Well No. 4



| PUMPTEST (Drawdown)   |                                | Lot 4 · Well No.         | Water Supply Evaluation - Karl Neff<br>4   |
|---|--------------------------------|--------------------------|--|
| Date test started: July 10th, 2001<br>Time test started: 12:00 Noon<br>Ave. pumping rate: 7.0 Igpm<br>Pre-test water level: 2.60 metres |                                |                          | Reference Point: Top of casing<br>Height of ref. point: 0.61 metres above grade<br>Depth of well: 17.4 metres (57 feet)<br>Screen Interval: Perforated liner 16.2 to 17.4 metres |
| Time (t) since<br>pumping started<br>in minutes   | Depth to<br>water in<br>metres | Drawdown<br>in<br>metres | Comments   |
| 0   | 2.60                           | 0.00                     |  |
| 1   | 2.64                           | 0.04                     |  |
| 2   | 2.69                           | 0.09                     | Pumping rate: 7.0 lgpm   |
| 3   | 2.76                           | 0.16                     |  |
| 4   | 2.820                          | 0.22                     |  |
| 6   | 2.830                          | 0.23                     |  |
| 8   | 2.83                           | 0.23                     |  |
| 10  | 2.83                           | 0.23                     |  |
| 13  | 2.83                           | 0.23                     |  |
| 16  | 2.83                           | 0.23                     |  |
| 20  | 2.83                           | 0.23                     |  |
|   | 2.04                           | 0.24                     |  |
| 32  | 2.04                           | 0.24                     |  |
| 40  | 2.03                           | 0.23                     |  |
| 50  | 2.85                           | 0.23                     | Pumping rate: 7.0 Janm   |
|   | 2.04                           | 0.24                     |  |
| 100   | 2.03                           | 0.23                     |  |
| 120   | 2.86                           | 0.26                     | ······································   |
| 150   | 2.85                           | 0.25                     |  |
| 190   | 2.85                           | 0.25                     |  |
| 240   | 2.85                           | 0.25                     | Pumping rate: 7.0 lgpm   |
| 300   | 2.86                           | 0.26                     |  |
| 380   | 2.85                           | 0.25                     |  |
| 480   | 2.86                           | 0.26                     |  |
| 600   | 2.88                           | 0.28                     | Pumping rate: 7.0 Igpm   |
| 780   | 2.87                           | 0.27                     |  |
| 960   | 2.88                           | 0.28                     |  |
| 1200  | 2.89                           | 0.29                     | Pumping rate: 7.0 Igpm   |
| 1440  | 2.90                           | 0.30                     | Obtain water samples   |
|   |                                |                          |  |
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Kala Groundwater Consulting Ltd.

# Water Supply Evaluation



| PUMPTEST (Drawdown)   |                                    | Lot 6 - Well No.                  | Water Supply Evaluation - Karl Neff<br>6  |
|---|------------------------------------|-----------------------------------|---|
| Date test started: July 4<br>Time test started: 5:00 I<br>Ave. pumping rate: 2.5 I<br>Pre-test water level: 14. | th, 2001<br>PM<br>gpm<br>33 metres |                                   | Reference Point: Top of casing<br>Height of ref. point: 0.15 metres above grade<br>Depth of well: 65.5 metres (215 feet)<br>Screen Interval: Perforated liner 9.0 to 65.0metres |
| Time (1) since<br>pumping started<br>in minutes   | Depth to<br>water in<br>metres     | Drawdown<br>in<br>metres          | Comments  |
| 0   | 14.33                              | 0.00                              |   |
| 1   | 14.55                              | 0.22                              |   |
| 2   | 14.76                              | 0.43                              | Pumping rate: 5.0 lgpm  |
| 3   | 14.96                              | 0.63                              | Water very cloudy   |
| 4   | 15.020                             | 0.69                              |   |
| 6   | 15.090                             | 0.76                              |   |
| 8   | 16.14                              | 1.81                              |   |
| 10  | 17.49                              | 3.16                              |   |
| 13  | 22.34                              | 8.01                              |   |
| 16  | 26.12                              | 11.79                             |   |
| 20  | 29.06                              | 14.73                             |   |
| 25  | 31.52                              | 17.19                             |   |
| 32  | 32.01                              | 17.68                             |   |
| 40  | 32.53                              | 18.20                             |   |
| 50  | 33.24                              | 18.91                             |   |
| 64  | 33.39                              | 19.06                             | Pumping rate: 5.0 Igpm  |
| 80  | 33.52                              | 19.19                             |   |
| 100   | 33.67                              | 19.34                             |   |
| 120   | 33.82                              | 19.49                             |   |
| 150   | 33.95                              | 19.62                             |   |
| 190   | 34.01                              | 19.68                             | Decrease rate to 4.0 Igpm   |
| 240   | 34.21                              | 19.88                             |   |
| 300   | 35.14                              | 20.81                             |   |
| 380   | 35.80                              | 21.47                             |   |
| 480   | 30.42                              | 22.09                             | Dumping webs 4.0 km as  |
|   | 3/.41                              | 23.08                             | Purriping rate 4.0 igpm   |
|   | 39.33                              | 25.00                             | Connet obtain reading reduce rate to 0.5 large  |
| 1260  | 42.33                              | 20.00                             | Pate 2.5 Japan  |
| 1200  | 40.31<br>27 52                     | 31.98                             | Pate : 2.5 lanm   |
| 1440  | 37.05                              | 23.20                             | Obtain water samples  |
| 1++0  |                                    | 22.10                             |   |
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PUMPTEST (Drawdown)

Water Supply Evaluation - Karl Neff Lot 7 - Well No. 7

Date test started: July 11th, 2001 Time test started: 1:30 PM Ave. pumping rate: 7.0 Igpm Pre-test water level: 24.82 metres Reference Point: Top of casing Height of ref. point: 0.25 metres above grade Depth of well: 93.0 metres (305 feet) Screen Interval: Perforated liner 105 to 92.0metres

| Time (t) since | Depth to<br>water in | Drawdown<br>in                        | Comments                               |
|----------------|----------------------|---------------------------------------|--|
| in minutes     | metres               | metres                                |  |
| 0              | 24.82                | 0.00                                  |  |
| 1              | 24.83                | 0.01                                  | <u> </u>                               |
| 2              | 24.84                | 0.02                                  | Pumping rate: 7.0 lgpm                 |
| 3              | 24.87                | 0.05                                  | Water very cloudy                      |
| 4              | 24.890               | 0.07                                  |  |
| 6              | 25.240               | 0.42                                  |  |
| 8              | 26.63                | 1.81                                  |  |
| 10             | 27.04                | 2.22                                  |  |
| 13             | 27.31                | 2.49                                  |  |
| 16             | 27.74                | 2.92                                  |  |
| 20             | 30.49                | 5.67                                  |  |
| 25             | 33.23                | 8.41                                  | Water clearing                         |
| 32             | 35.32                | 10.50                                 |  |
| 40             | 35.88                | 11.06                                 |  |
| 50             | 36.00                | 11.18                                 |  |
| 64             | 36.10                | 11.28                                 | Pumping rate: 7.0 lgpm                 |
| 80             | 36.51                | 11.69                                 |  |
| 100            | 36.98                | 12.16                                 |  |
| 120            | 37.43                | 12.61                                 |  |
| 150            | 38.18                | 13.36                                 |  |
| 190            | 38.45                | 13.63                                 | Pumping rate: 7.0 lgpm                 |
| 240            | 39.57                | 14.75                                 | Water Still a little cloudy            |
|                | 40.23                | 15.41                                 |  |
| 380            | 41.37                | 16.55                                 |  |
| 480            | 43.02                | 18.20                                 |  |
| 600            | 46.07                | 21.25                                 | Pumping rate 7.0 Igpm                  |
| 780            | 48.34                | 23.52                                 |  |
| 960            | 49.21                | 24.39                                 | ······································ |
| 1200           | 48.49                | 23.67                                 | Pumping rate: 7.0 Igpm                 |
| 1440           | 48.37                | 23.55                                 | Obtain water samples                   |
|                |                      |                                       |  |
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Kala Groundwater Consulting Ltd.

# PUMPTEST (Drowdown) Water Supply Evaluation - Karl Neff Lot 8 - Well No. 8

Date test started: July 5th, 2001 Time test started: 6:00 PM Ave. pumping rate: 5.0 lgpm Pre-test water level: 18:45 metres Reference Point: Top of casing Height of ref. point: 0.3 metres above grade Depth of well: 92.0 metres (302 feet) Screen Interval: Perforated liner 5.0 to 92.0 metres

| Time (1) since<br>pumping started<br>in minutes | Depth to<br>water in<br>metres | Drawdown<br>in<br>metres | Comments                  |
|---|--------------------------------|--------------------------|---------------------------|
| 0   | 18.45                          | 0.00                     |                           |
| 1   | 18.46                          | 0.01                     |                           |
| 2   | 18.47                          | 0.02                     | Pumping rate: 6.0 lgpm    |
| 3   | 18.48                          | 0.03                     |                           |
| 4   | 18.490                         | 0.04                     |                           |
| 6   | 18.500                         | 0.05                     |                           |
| 8   | 18.74                          | 0.29                     |                           |
| 10  | 19.22                          | 0.77                     |                           |
| 13  | 19.64                          | 1.19                     |                           |
| 16  | 20.01                          | 1.56                     |                           |
| 20  | 25.62                          | 7.17                     |                           |
| 25  | 33.84                          | 15.39                    |                           |
| 32  | 41.73                          | 23.28                    |                           |
| 40  | 50.92                          | 32.47                    |                           |
| 50  | 56.21                          | 37.76                    |                           |
| 64  | 56.95                          | 38.50                    | Pumping rate: 6.0 lgpm    |
| 80  | 57.41                          |                          |                           |
| 100   | 57.90                          | 39.45                    |                           |
| 120   | 58.11                          | 39.66                    |                           |
| 150   | 58.20                          | 39.75                    |                           |
| 190   | 58.44                          | 39.99                    | Pumping rate: 6.0 Igpm    |
| 240   | 58.81                          | 40.36                    |                           |
| 300   | 59.10                          | 40.65                    |                           |
| 380   | 59.39                          | 40.94                    |                           |
| 480   | 60.01                          | 41.56                    |                           |
| 600   | 60.94                          | 42.49                    | Pumping rate 6.0 lgpm     |
| 780   | 61.20                          | 42.75                    | Decrease rate to 5.0 Igpm |
| 960   | 61.02                          | 42.57                    | Pumping rate: 5.0 Igpm    |
| 1200  | 61.58                          | 43.13                    | Obtain water samples      |
|   |                                |                          |                           |
|   |                                |                          |                           |
|   |                                | ·····                    |                           |
|   |                                |                          |                           |
|   |                                |                          |                           |
|   |                                |                          |                           |
|   |                                |                          |                           |
|   | -                              |                          |                           |
|   |                                |                          |                           |
| ······································          |                                |                          |                           |
|   |                                |                          |                           |
|   |                                |                          |                           |



Kala Groundwater Consulting Ltd.

# APPENDIX D

Water Quality Analysis



102 - 3677 Highway 97N Kelowna, B.C. V1X 5C3

Telephone (250) 765-9646 Fax (250) 765-3893



# CERTIFICATE OF ANALYSIS

July 23, 2001

Kala Groundwater Consulting Ltd. Suite 3, 3107A - 31st Avenue VERNON, BC V1T 2G9

Attn: Larry Topp

# Sample ID: Karl Neff - Apex, Well #1 - Lot #1

Sampled: July 5/01 Received: July 5/01

| 77       | mg/L as CaCO <sub>3</sub>   |
|----------|---|
| <0.2     | mg/L  |
| <0.01    | mg/L  |
| 0.06     | mg/L  |
| <0.1     | mg/l.   |
| <0.0002  | mg/L  |
| 40.1     | mg/L  |
| 10.8     | mg/L  |
| <0.01    | mg/L  |
| <5       | Color Units   |
| 282      | umhos/cm  |
| <0.01    | mg/L  |
| <0.010   | mg/L  |
| 177      | mg/L  |
| <0.10    | mg/L  |
| 136      | mg/L as CaCO <sub>3</sub>   |
| 0.05     | mg/L  |
| <0.001   | mg/L  |
| 8.8      | mg/L  |
| <0.005   | mg/L  |
| <0.00005 | mg/L  |
| <0.03    | mg/L  |
| 0.78     | mg/L as N   |
| <0.01    | mg/L as N   |
|          | 77<br><0.2<br><0.01<br>0.06<br><0.1<br><0.0002<br>40.1<br>10.8<br><0.01<br><5<br>282<br><0.01<br><0.010<br>177<br><0.10<br>136<br>0.05<br><0.001<br>8.8<br><0.005<br><0.0005<br><0.0005<br><0.03<br>0.78<br><0.01 |

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Page 2 Kala Groundwater Consulting July 23, 2001 (cont)

#### Karl Neff - Apex, Well #1, Lot #1

| рH             | 6.9     | pH Units       |
|----------------|---------|----------------|
| Potassium      | 2.42    | mg/L           |
| Sodium         | 6.0     | mg/L           |
| Sulphate       | 33      | mg/L           |
| Turbidity      | 0.25    | N.T.U.         |
| Uranium        | 0.00090 | mg/L           |
| Zinc           | 0.007   | mg/L           |
| Total Coliform | 0       | colonies/100mL |
| Fecal Coliform | 0       | colonies/100mL |

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102 - 3677 Highway 97N Kelowna, B.C. V1X 5C3

Telephone (250) 765-9646 Fax (250) 765-3893

CERTIFICATE OF ANALYSIS

July 23, 2001

Kala Groundwater Consulting Ltd. Suite 3, 3107A - 31st Avenue VERNON, BC V1T 2G9

Attn: Larry Topp

.

# Sample ID: Karl Neff - Apex, Well #2 - Lot #2

Sampled: July 4/01 Received: July 5/01

| Alkalinity (Total)      | 76       | mg/L as CaCO <sub>2</sub> |
|-------------------------|----------|---------------------------|
| Aluminum                | <0.2     | mg/I.                     |
| Arsenic                 | <0.01    | mg/L                      |
| Barium                  | 0.08     | mg/L                      |
| Boron                   | <0.1     | mg/L                      |
| Cadmium                 | <0.0002  | mg/L                      |
| Calcium                 | 42.3     | mg/L                      |
| Chloride                | 21.8     | mg/L                      |
| Chromium                | <0.01    | mg/L                      |
| Color (True)            | <5       | Color Units               |
| Conductivity @ 250      | 296      | umhos/cm                  |
| Copper                  | <0.01    | mg/L                      |
| Cyanide                 | <0.010   | mg/L                      |
| Dissolved Solids(Total) | 180      | mg/L                      |
| Fluoride                | <0.10    | mg/L                      |
| Hardness(Total)         | 138      | mg/L as CaCOa             |
| Iron                    | 0.10     | mg/L                      |
| Lead                    | 0.002    | mg/L                      |
| Magnesium               | 7.8      | mg/L                      |
| Manganese               | <0.005   | mg/L                      |
| Mercury                 | <0.00005 | mg/L                      |
| Molybdenum              | <0.03    | mg/L                      |
| Nitrate                 | 2.50     | mg/L as N                 |
| Nitrite                 | <0.01    | mg/Las N                  |

...2

07/23/2001 21:28 2507653893

Page 2 Kala Groundwater Consulting July 23, 2001 (cont)

#### Karl Neff - Apex, Well #2, Lot #2

| На             | 6.7     | pH Units       |
|----------------|---------|----------------|
| Potassium      | 2.26    | mg/L           |
| Sodium         | 6.0     | mg/L           |
| Sulphate       | 20      | mg/L           |
| Turbidity      | 2.6     | N.T.U.         |
| Uranium        | 0.00150 | mg/L           |
| Zinc           | 0.1.1.4 | mg/L           |
| Total Coliform | 320     | colonies/100mL |
| Fecal Coliform | 0       | colonies/100mL |

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Telephone (250) 765-9646 Fax (250) 765-3893

CERTIFICATE OF ANALYSIS

July 25, 2001

Kala Groundwater Consulting Suite 3, 3107A - 31st Avenue VERNON, BC V1T 2G9 Attention: Larry Topp

Sample ID:

Karl Neff - Apex, Well #3 - Lot 3

Date sampled:

July 11/01

Received: July 11/01

| Parameter          | units         | Result  |
|--------------------|---------------|---------|
| Alkalinity (total) | mg/L as CaCO3 | 66      |
| Aluminum (total)   | mg/L          | <0,2    |
| Arsenic (total)    | mg/L          | <0.01   |
| Barium (total)     | mg/L          | 0.02    |
| Boron              | mg/L          | <0.1    |
| Cadmium (total)    | mg/L          | <0.0002 |
| Calcium (total)    | mg/L          | 25.2    |
| Chloride           | mg/L          | 16.8    |
| Chromium (total)   | mg/L          | <0.01   |
| Colour (true)      | colour units  | <5      |
| Conductivity       | umhos         | 208     |
| Copper (total)     | mg/L          | <0.01   |
| Cyanide            | mg/L          | <0.010  |
| Fluoride           | mg/L          | 0.20    |
| Hardness           | mg/L as CaCO3 | 84      |
| Iron (total)       | mg/L          | 0.05    |
| Lead (total)       | mg/L          | <0.001  |
| Magnesium (total)  | mg/I.         | 5.2     |
| Manganese (total)  | mg/L          | <0.005  |
| Mercury (total)    | mg/L          | 0.00013 |
| Molybdenum         | mg/L          | <0.03   |





Page 2 Kala Groundwater Consulting July 25, 2001 (cont)

| Sample ID:             | Kaxl Neff - Apex, Well # | #3 - Lot 3    |
|------------------------|--------------------------|---------------|
| Parameter              | <u>units</u>             | <u>Result</u> |
| Nitrate                | mg/l as N                | 0.34          |
| Nitrite                | mg/L as N                | <0.01         |
| рH                     | pH units                 | 6.8           |
| Potassium (total)      | mg/L                     | 1.79          |
| Sodium (total)         | mg/L                     | 7             |
| Sulphate               | mg/L                     | 7.6           |
| Total Dissolved Solids | mg/L                     | 140           |
| Turbidity              | NTU                      | 0.6           |
| Uranium (total)        | mg/L                     | 0.00143       |
| Zinc (total)           | mg/L                     | <0.005        |
| Total Coliform         | Colonies/100mL           | 0             |
| Fecal Coliform         | Colonies/100mL           | 0             |

Certified by:

CARO Environmental Services Janice M. Fraser, B.Sc., Lab Manager

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Received: July 11/01

#### CERTIFICATE OF ANALYSIS

July 26, 2001

Kala Groundwater Consulting Suite 3, 3107A - 31st Avenue VERNON, BC V1T 2G9 Attention: Larry Topp

Sample ID:

Date sampled:

Karl Neff - Apex, Well #4 - Lot 4

| Parameter          | <u>units</u>  | Result   |
|--------------------|---------------|----------|
| Alkalinity (total) | mg/L as CaCO3 | 144      |
| Aluminum (total)   | mg/L          | <0.2     |
| Arsenic (total)    | mg/L          | <0.01    |
| Barium (total)     | mg/L          | 0.02     |
| Boron              | mg/L          | <0.1     |
| Cadmium (total)    | mg/L          | <0.0002  |
| Calcium (total)    | mg/L          | 33.8     |
| Chloride           | mg/L          | 13.0     |
| Chromium (total)   | mg/L          | <0.01    |
| Colour (true)      | colour units  | <5       |
| Conductivity       | umitos        | 332      |
| Copper (total)     | mg/L          | <0.01    |
| Cyanide            | mg/L          | <0.010   |
| Fluoride           | mg/L          | 0.50     |
| Hardness           | mg/L as CaCO3 | 131      |
| Iron (total)       | mg/L          | 0.09     |
| Lead (total)       | mg/L          | <0.001   |
| Magnesium (total)  | mg/L          | 11.4     |
| Manganese (total)  | mg/L          | 0.005    |
| Mercury (total)    | mg/L          | <0.00005 |
| Molybdenum         | mg/L          | <0.03    |

July 11/01

Page 2 Kala Groundwater Consulting July 26, 2001 (cont)

| Karl Neff - Apex, Well 4 | 4 - Lot 4   |
|--------------------------|---|
| <u>units</u>             | Result  |
| mg/L as N                | 0.33  |
| mg/L as N                | <0.01   |
| pH units                 | 7.3   |
| mg/L                     | 2.15  |
| mg/L                     | 23  |
| mg/L                     | 9.4   |
| mg/L                     | 214   |
| NTU                      | 0.3   |
| mg/I                     | 0.00253   |
| mg/L                     | <0.005  |
| Colonies/100mL           | * 0   |
| background greater than  | 200 col/100mL   |
| Colonies/100mL           | 0   |
|                          | Karl Neff - Apex, Well 4<br>Units<br>mg/L as N<br>mg/L as N<br>pH units<br>mg/L<br>mg/L<br>mg/L<br>Mg/L<br>NTU<br>mg/L<br>Colonies/100mL<br>background greater than<br>Colonies/100mL |

an Certified by: \ 7au

CARØ Environmental Services Janice M. Fraser, B.Sc., Lab Manager

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102 - 3677 Highway 97N Kelowna, B.C. V1X 5C3

Telephone (250) 765-9646 Fax (250) 765-3893

# CERTIFICATE OF ANALYSIS

July 23, 2001

Kala Groundwater Consulting Ltd. Suite 3, 3107A - 31st Avenue VERNON, BC V1T 2G9

Attn: Larry Topp

# Sample ID: Karl Neff - Apex, Well #6 - Lot #6

Sampled: July 5/01 Received: July 6/01

| Alkalinity (Total)      | 226      | mg/L as CaCO3 |
|-------------------------|----------|---------------|
| Aluminum                | <0.2     | mg/I.         |
| Arsenic                 | <0.01    | mg/L          |
| Barium                  | 0.04     | mg/L          |
| Boron                   | <0.1     | mg/L          |
| Cadmium                 | <0.0002  | mg/L          |
| Calcium                 | 44.1     | mg/L          |
| Chloride                | 19.6     | mg/L          |
| Chromium                | <0.01    | mg/L          |
| Color (True)            | <5       | Color Units   |
| Conductivity @ 25°      | 588      | umhos/cm      |
| Copper                  | <0.01    | mg/L          |
| Cyanide                 | <0.010   | mg/L          |
| Dissolved Solids(Total) | 357      | mg/L          |
| Fluoride                | 0.50     | mg/L          |
| Hardness(Total)         | 146      | mg/L as CaCO3 |
| Iron                    | 0.20     | mg/L          |
| Lead                    | <0.001   | mg/L          |
| Magnesium               | 21.0     | mg/L          |
| Manganese               | 0.069    | mg/L          |
| Mercury                 | <0.00005 | mg/L          |
| Molybdenum              | <0.03    | mg/L          |
| Nitrate                 | <0.01    | mg/L as N     |
| Nitrite                 | <0.01    | mg/L as N     |
|                         |          |               |

Page 2 Kala Groundwater Consulting July 23, 2001 (cont)

# Karl Neff ~ Apex, Well #6, Lot #6

| 3.30<br>60<br>57<br>0.95<br>0.00120<br>0.336<br>0 | <pre>pH Units mg/L mg/L mg/L N.T.U. mg/L mg/L colonies/100mL Colonies/100mL</pre> |
|---|---|
|   | 3.30<br>60<br>57<br>0.95<br>0.00120<br>0.336<br>0<br>0                            |

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CERTIFICATE OF ANALYSIS

July 30, 2001

Kala Groundwater Consulting Suite 3, 3107A - 31st Avenue VERNON, BC V172G9 Attention: Larry Topp

Sample ID:

Karl Neff - Apex, Well #7

Date sampled:

July 12/01, 1230

Received: July 12/01

| Parameter          | units         | <u>Result</u> |
|--------------------|---------------|---------------|
| Alkalinity (total) | mg/L as CaCO3 | 306           |
| Aluminum (total)   | mg/L          | 0.2           |
| Arsenic (total)    | mg/L          | <0.01         |
| Barium (total)     | mg/L          | 0.01          |
| Boron              | mg/L          | 0.1           |
| Cadmium (total)    | mg/L          | <0.0002       |
| Calcium (total)    | mg/L          | 8.28          |
| Chloride           | mg/L          | 11.5          |
| (total)            | mg/L          | <0.01         |
| Colour (true)      | colour units  | 7             |
| Conductivity       | umhos         | 668           |
| Copper (total)     | mg/L          | <0.01         |
| Cyanide            | mg/L          | <0.010        |
| Fluoride           | mg/L          | 0.50          |
| Hardness           | mg/L as CaCO3 | 59            |
| Iron (total)       | mg/L          | 0.24          |
| Lead (total)       | mg/L          | <0.001        |
| Magnesium (total)  | mg/L          | 9.31          |
| Manganese (total)  | mg/L          | 0.033         |
| Mercury (total)    | mg/L          | <0.00005      |
| Molybdenum         | mg/L          | <0.03         |

...2

Page 2 Kala Groundwater Consulting July 30, 2001 (cent)

| Sample ID:             | Karl Neff - Apex, Well #7 |         |
|------------------------|---------------------------|---------|
| Parameter              | units                     | Result  |
| Nitrate                | mg/L as N                 | 0.01    |
| Nitrite                | mg/L as N                 | <0.01   |
| pH                     | pH units                  | 8.2     |
| Potassium (total)      | mg/L                      | 1.12    |
| Sodium (total)         | mg/L                      | 145     |
| Sulphate               | mq/L                      | 41      |
| Total Dissolved Solids | mg/L                      | 420     |
| Turbidity              | NTU                       | 6.3     |
| Uranium (total)        | mg/L                      | 0.00143 |
| Zinc (total)           | mg/L                      | 0,228   |
| Total Coliform         | Colonies/100mL            | C       |
| Fecal Coliform         | Colonies/100mL            | C       |

Certified by:

CARO Environmental Services Janice M. Fraser, B.Sc., Lab Manager

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#### CERTIFICATE OF ANALYSIS

July 23, 2001

Kala Groundwater Consulting Ltd. Suite 3, 3107A - 31st Avenue VERNON, BC V1T 2G9

Attn: Larry Topp

# Sample ID: Karl Neff - Apex, Well #8 - Lot #8

Sampled: July 6/01 Received: July 6/01

| Alkalinity (Total)      | 256      | mg/L as CaCO <sub>3</sub> |
|-------------------------|----------|---------------------------|
| Aluminum                | <0.2     | mg/L                      |
| Arsenic                 | <0.01    | mg/L                      |
| Barium                  | <0.01    | mg/L                      |
| Boron                   | 0.2      | mg/l                      |
| Cadmium                 | <0,0002  | mg/L                      |
| Calcium                 | 13.7     | mg/L                      |
| Chloride                | 14.8     | mg/L                      |
| Chromium                | <0.01    | mg/L                      |
| Color (True)            | <\$      | Color Units               |
| Conductivity @ 250      | 583      | umhos/cm                  |
| Copper                  | <0.01    | mg/L                      |
| Cyanide                 | <0.010   | mg/L                      |
| Dissolved Solids(Total) | 359      | mg/L                      |
| Fluoride                | 0.95     | mg/L                      |
| Hardness (Total)        | 59       | mg/L as CaCO <sub>3</sub> |
| Iron                    | <0.03    | mg/L                      |
| Lead                    | <0.001   | mg/L                      |
| Magnesium               | 5.9      | mg/L                      |
| Manganese               | 0.007    | mg/L                      |
| Mercury                 | <0.00005 | mg/L                      |
| Molybdenum              | <0.03    | mg/L                      |
| Nitrate                 | <0.01    | mg/L as N                 |
| Nitrite                 | <0.01    | mg/L as N                 |
|                         |          |                           |

...2

Page 2 Kala Groundwater Consulting July 23, 2001 (cont)

# Karl Neff - Apex, Well #8, Lot #8

| На             | 8.1     | pH Units       |
|----------------|---------|----------------|
| Potassium      | 1.31    | mg/L           |
| Sodium         | 120     | mg/L           |
| Sulphate       | 31      | mg/L           |
| Turbidity      | 0.10    | N.T.U.         |
| Uranium        | 0.00273 | mg/L           |
| Zinc           | 0.240   | mg/L           |
| Total Coliform | 0       | colonies/100mL |
| Fecal Coliform | 0       | colonies/100mL |

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