REGIONAL DISTRICT OF NORTH OKANAGAN

BYLAW No. 2850

A bylaw to rezone lands and amend the Zoning Map attached to the Regional District of North Okanagan Zoning Bylaw No. 1888, 2003 to change a zone designation

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WHEREAS pursuant to Section 479 [Zoning bylaws] of the *Local Government Act*, the Board of the Regional District of North Okanagan may, by Bylaw, divide the whole or part of the Regional District into zones, name each zone, establish boundaries for the zones and regulate uses within those zones;

AND WHEREAS the Board has created zones, named each zone, established boundaries for these zones and regulated uses within those zones by Bylaw No. 1888, being the *"Regional District of North Okanagan Zoning Bylaw No. 1888, 2003"* as amended;

AND WHEREAS, pursuant to Section 460 *[Development approval procedures]* of the *Local Government Act*, the Board must, by bylaw, define procedures under which an owner of land may apply for an amendment to a Zoning Bylaw and must consider every application for an amendment to the bylaw;

AND WHEREAS the Board has enacted the *"Regional District of North Okanagan Development Application Procedures and Administrative Fees Bylaw No. 2677, 2018"* as amended to establish procedures to amend an Official Community Plan, a Zoning Bylaw, or a Rural Land Use Bylaw, or to issue a Permit:

AND WHEREAS the Board has received an application to rezone property;

NOW THEREFORE, the Board of the Regional District of North Okanagan in open meeting assembled, hereby **ENACTS AS FOLLOWS**:

CITATION

1. This Bylaw may be cited as ***"Zoning Amendment Bylaw No. 2850, 2019"***.

AMENDMENTS

2. The zoning of the property legally described as Lot 1, Sec 25, Twp 8, ODYD, Plan 2558, Except Plan 37038 and Plan EPP74629 and located at McLennan Road, Electoral Area "C" is hereby changed on Schedule "A" of the *Regional District of North Okanagan Zoning Bylaw No. 1888, 2003* from the ***Non-Urban Zone [N.U]*** to the ***Country Residential Zone [C.R]***.

Read a First Time	this	11th	day of	December, 2019
Read a Second Time	this	22nd	day of	March, 2023
Advertised on	this	20th	day of	October, 2023
	this	24th	day of	October, 2023
Public Hearing held	this	2nd	day of	November, 2023
Read a Third Time	this		day of	, 2023

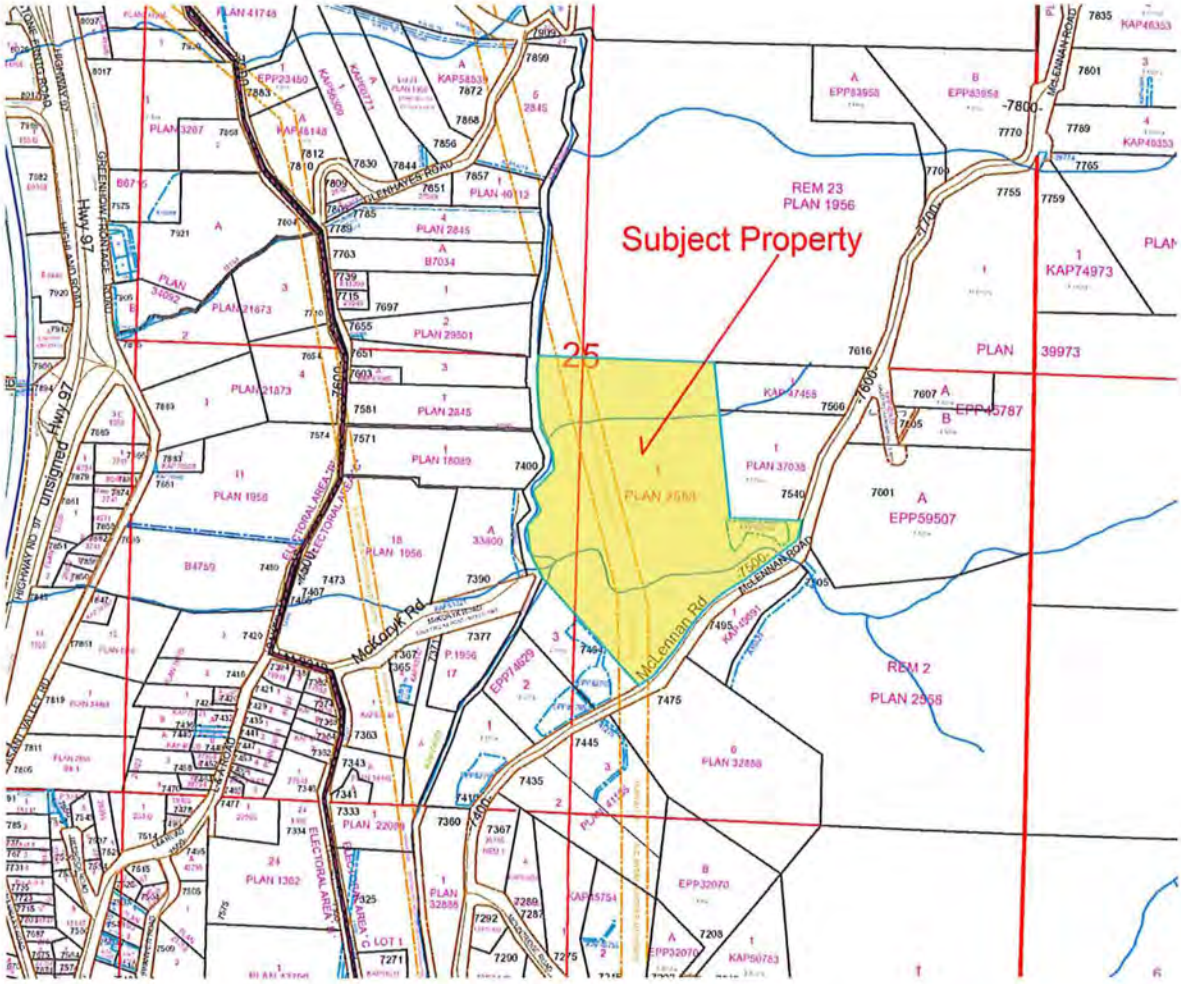
ADOPTED this day of , 2023

Chair

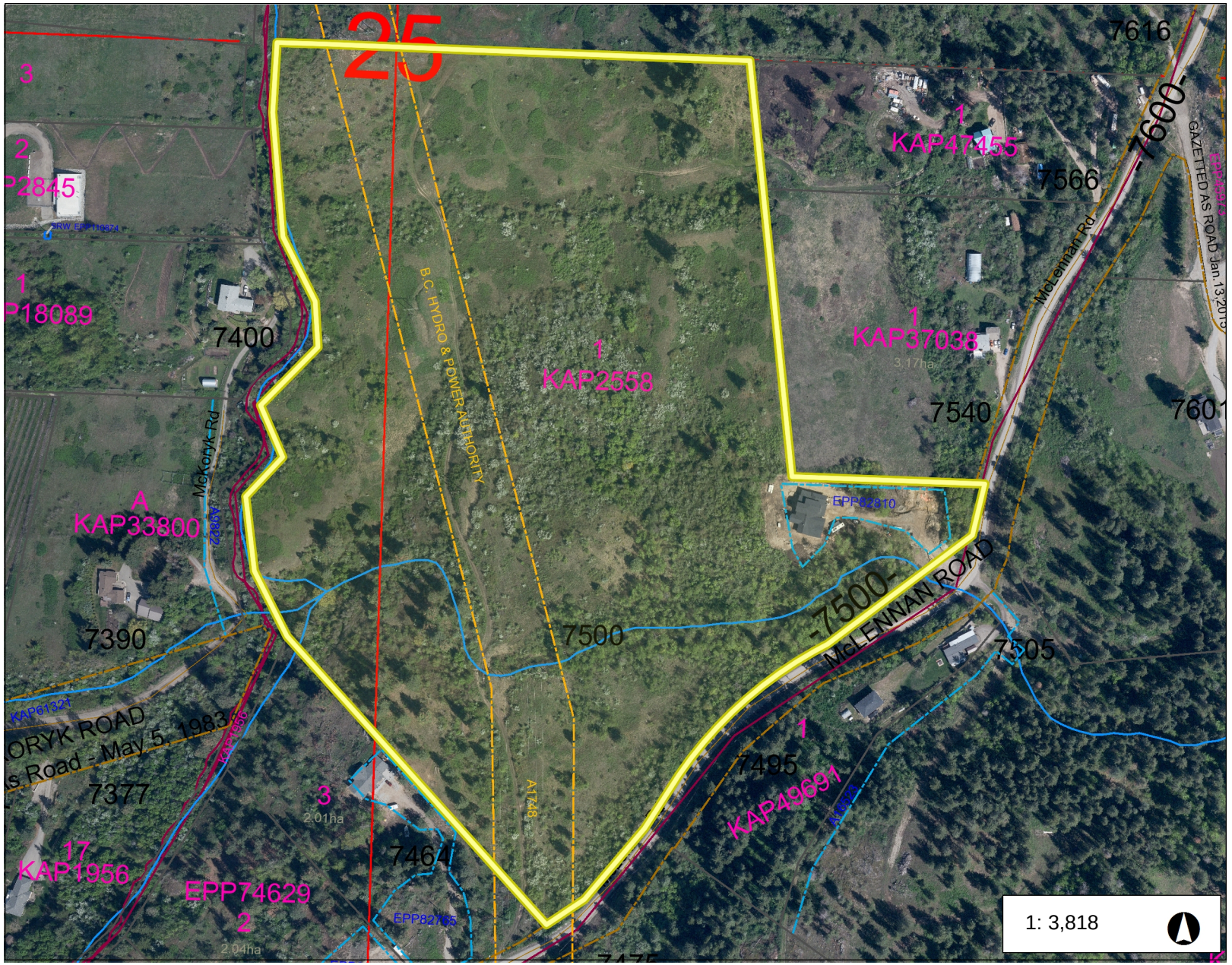
Corporate Officer

SUBJECT PROPERTY MAP

File: 19-0906-C-RZ
Owner/Applicant: Viktor Malyakin
Location: 7500 McLennan Road



Regional District of North Okanagan Mapping Site



1: 3,818

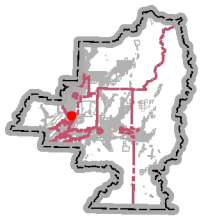
194.0 0 96.98 194.0 Meters

NAD_1983_UTM_Zone_11N

Date and TIme Printed: 10/16/2023 12:19 PM

This map is a user generated static output from an Internet mapping site and is for reference only. Data layers that appear on this map may or may not be accurate, current, or otherwise reliable.

THIS MAP IS NOT TO BE USED FOR NAVIGATION



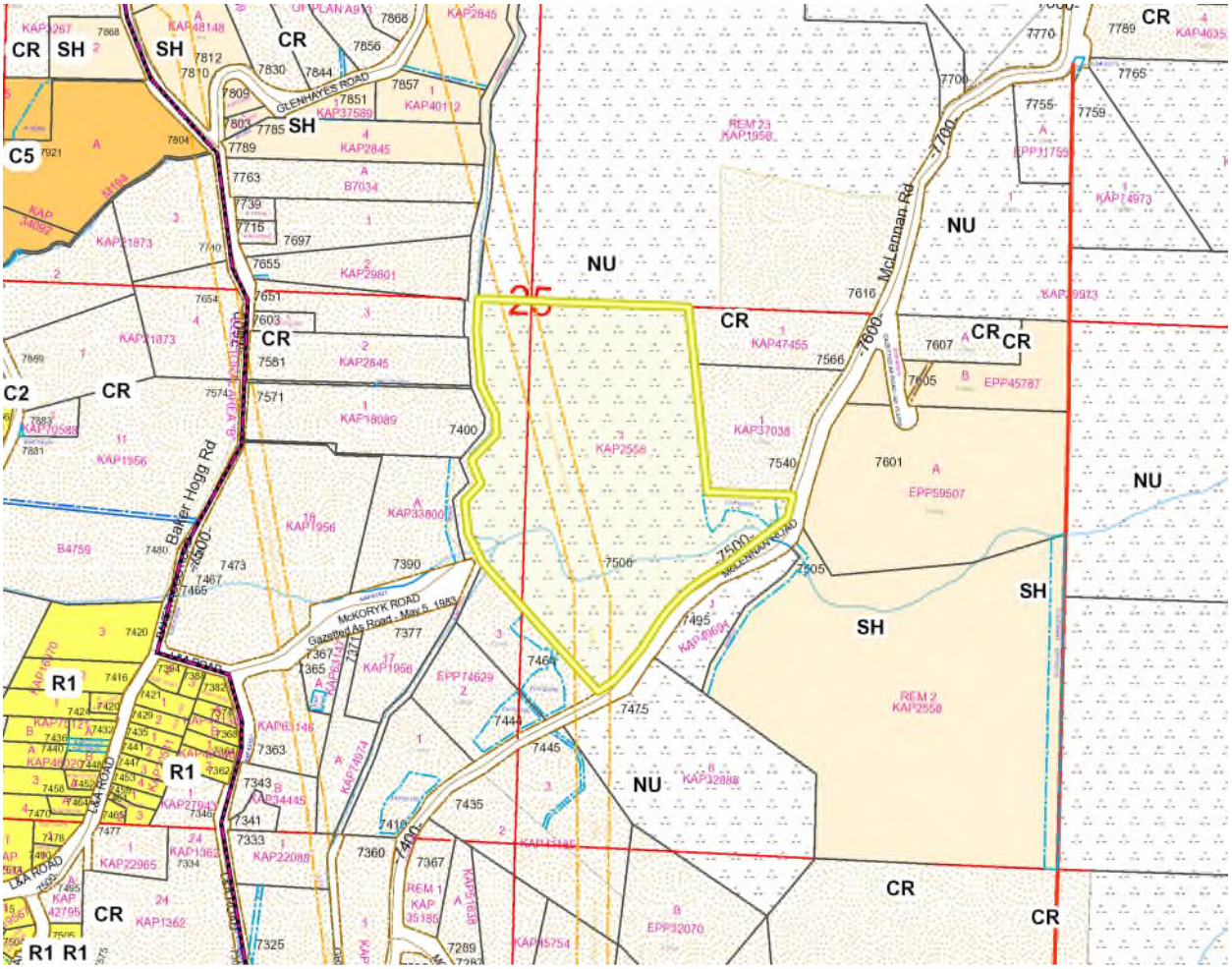
Legend

- Parcels
- First Nations Reserves
- Lakes
- Regional Districts
  - Regional District of North Okanagan
  - Other Regional Districts
- Parks_PAs_ERs
  - ER
  - PA
  - PK
- Area Parks
- Trails

Notes

SUBJECT PROPERTY MAP
ZONING BOUNDARIES

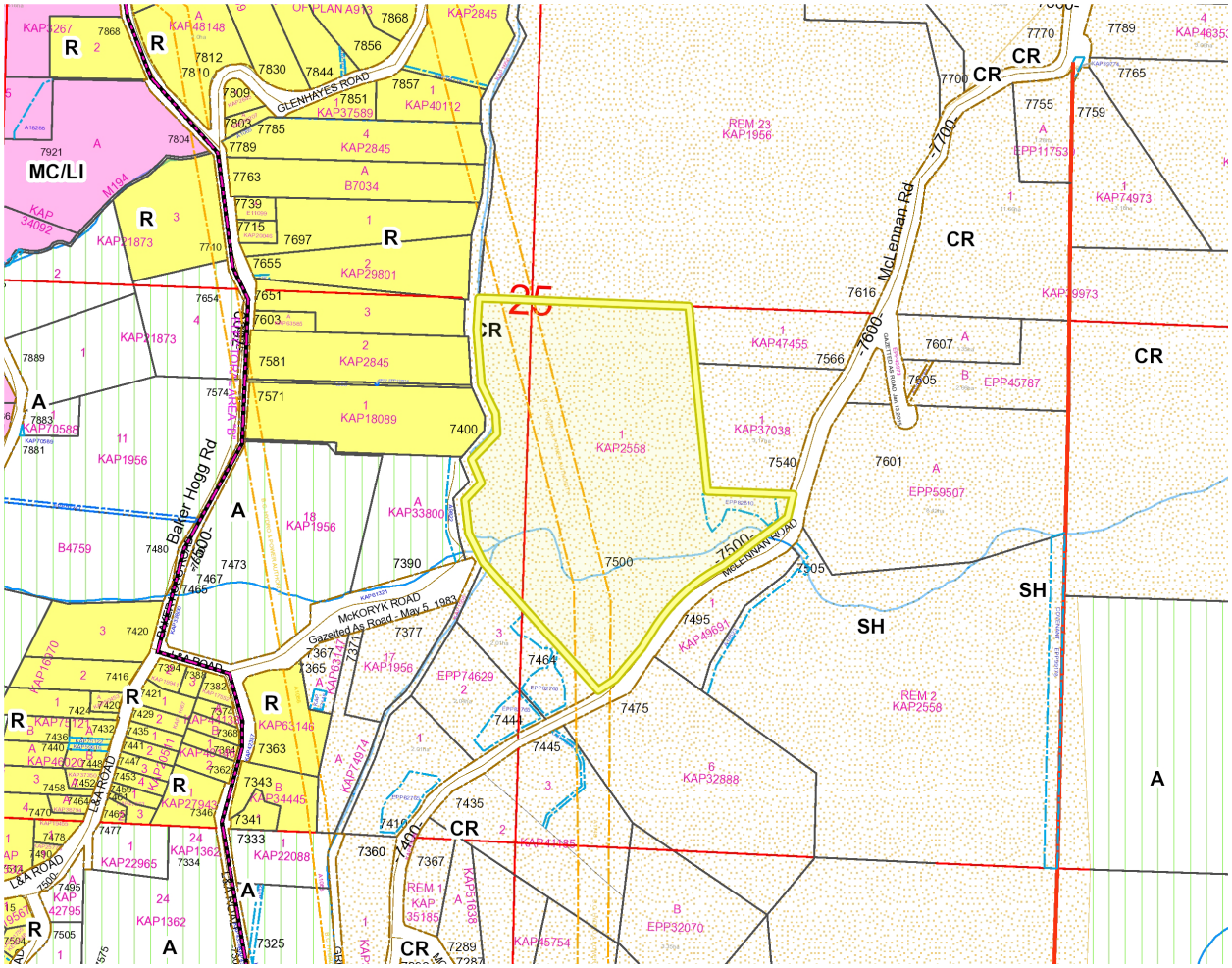
File: **19-0906-C-RZ**
Location: **7500 McLennan Road**



C.5 – Recreation Commercial
C.R – Country Residential
N.U – Non-Urban
R.1 – Residential Single Family
S.H – Small Holding

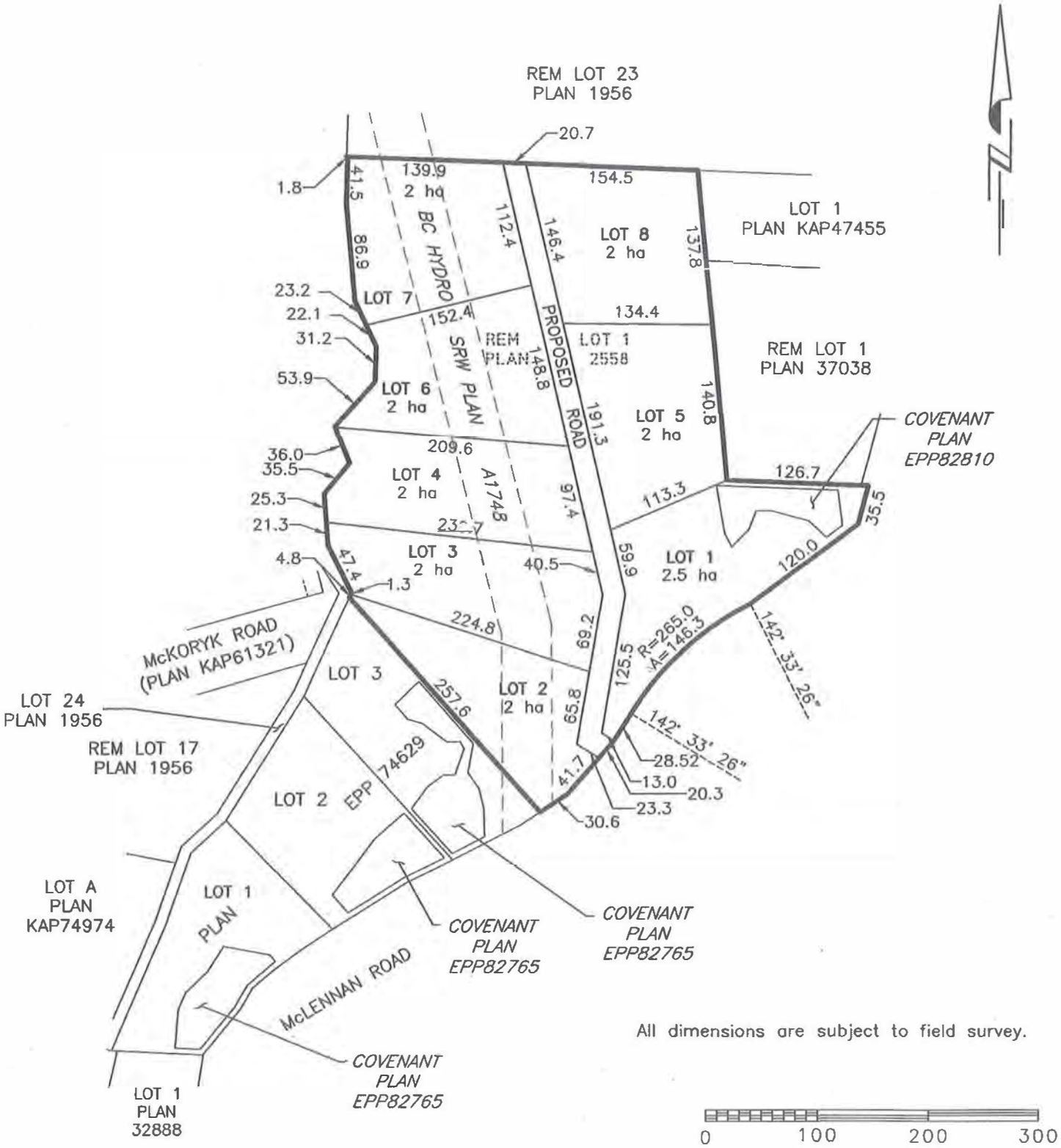
SUBJECT PROPERTY MAP
OCP BOUNDARIES

File: **19-0906-C-RZ**
Location: **7500 McLennan Road**



A – Agricultural
CR – Country Residential
SH – Small Holding
MC/LI – Mixed Commercial / Light Industrial
R - Residential

ALL DISTANCES ARE IN METRES.



PLAN OF PROPOSED REZONING AND SUBDIVISION OF LOT 1, PLAN 2558, SEC 25, TP 8, ODYD EXCEPT PLANS 37038 & EPP74629

106750A01

SCALE: 1 : 5000	OUR FILE: R10675
DATE: 30 Sep 2019	DRAWN: KG

Dacron Enterprises Ltd

MADDOX & COMPANY
LAND SURVEYORS
3500 – 30th STREET
VERNON, BC V1T 5E8
TELEPHONE: (250) 542-4343

REGIONAL DISTRICT OF NORTH OKANAGAN

Extract from the Minutes of a Meeting of the

Board of Directors

Held on

Wednesday, September 27, 2023

Bylaw 2850 - Zoning Amendment
MALYAKIN, V. [File No. 19-0906-C-RZ]
7500 McLennan Road, Electoral Area "C"

Moved and seconded
That Final Adoption of Zoning Amendment Bylaw No. 2850 which proposes to rezone the property legally described as Lot 1, Sec 25, Twp 8, ODYD, Plan 2558, Except Plan 37038 and Plan EPP74629 and located at 7500 McLennan Road, Electoral Area “C” from the Non-Urban (N.U) zone to the Country Residential (C.R) zone be withheld until the applicant has registered a covenant against the title of the subject property which would:

1. prohibit subdivision of the property until a professional hydrologist has verified that all wells proposed to service all new lots are proven to meet the quantity and quality standards of the Regional District of North Okanagan Subdivision Servicing Bylaw No. 2600 and that the extraction of water from the wells will not negatively impact the water supply of neighbouring wells.
2. require that all wells proposed to service all new lots be pump tested for a minimum of 72 hours to confirm that they meet the quantity standards of Subdivision Servicing Bylaw No. 2600;
3. require that all wells proposed to service all new lots be located so that they are at least 50 m from each other and from neighbouring wells.
4. require as a condition of subdivision approval that at least one observation well be monitored during the pumping test for wells that would service new lots. The observation well must be located no more than 300 m from the wells that would service the new lots or a distance established by a professional hydrologist with technical justification for the distance.

CARRIED

REGIONAL DISTRICT NORTH OKANAGAN

STAFF REPORT

TO:	**Board of Directors**	**File No:**	**19-0906-C-RZ**
FROM:	**Planning Department**	**Date:**	**July 27, 2023**

SUBJECT: Zoning Amendment Bylaw No. 2850, 2019

RECOMMENDATION:

That Final Adoption of Zoning Amendment Bylaw No. 2850 which proposes to rezone the property legally described as Lot 1, Sec 25, Twp 8, ODYD, Plan 2558, Except Plan 37038 and Plan EPP74629 and located at 7500 McLennan Road, Electoral Area "C" from the Non-Urban (N.U) zone to the Country Residential (C.R) zone be withheld until the applicant has registered a covenant against the title of the subject property which would:

1. prohibit subdivision of the property until a professional hydrologist has verified that all wells proposed to service all new lots are proven to meet the quantity and quality standards of the Regional District of North Okanagan Subdivision Servicing Bylaw No. 2600 and that the extraction of water from the wells will not negatively impact the water supply of neighbouring wells.
2. require that all wells proposed to service all new lots be pump tested for a minimum of 72 hours to confirm that they meet the quantity standards of Subdivision Servicing Bylaw No. 2600;
3. require that all wells proposed to service all new lots be located so that they are at least 50 m from each other and from neighbouring wells.
4. require as a condition of subdivision approval that at least one observation well be monitored during the pumping test for wells that would service new lots. The observation well must be located no more than 300 m from the wells that would service the new lots or a distance established by a professional hydrologist with technical justification for the distance.

BACKGROUND:

The subject application proposes to rezone an approximately 17 ha property located at 7500 McLennan Road from the Non-Urban (N.U) zone to the Country Residential (C.R) zone. If successful in rezoning the property, the applicant is proposing an eight (8) lot subdivision.

At the Regular Meeting held on December 11, 2019, the Board of Directors considered the application and gave First Reading to the associated Zoning Amendment Bylaw No. 2850, 2019. The Board resolved that Second Reading of Bylaw No. 2850 be withheld until the Regional District completes the Keddleston Groundwater Study and the study has confirmed the adequacy of water supply for the level of potential development in the study area. The Board further resolved that Final Adoption of Bylaw No. 2850 be withheld until the applicant has made suitable arrangements with the Regional District to provide an approximate 0.5 m to 1.0 m wide public hiking trail within a 6 m wide Statutory Right of Way that would link McLennan Road through the subject property to the existing Grey Canal Trail.

At the Regular Meeting held on May 20, 2020, the Board of Directors again resolved that further consideration of Bylaw No. 2850 be withheld until the comprehensive review of the water supply in Aquifer 351 had been completed.

At the Regular Meeting held on July 20, 2022, the Board of Directors endorsed a report from Golder Associates Ltd titled "Keddleston Groundwater Study – Phase 2" and dated June 29, 2022. After considering the report, the Board passed the following resolution:

> *That staff be directed to bring back a report on the implications of the recommendations contained in the report on in-process land use applications for properties in Electoral Area "C".*

At the Regular Meeting held on December 14, 2022, the Board considered the subject application along with the Phase 2 Keddleston Groundwater Study and other in-process land use applications for properties in Electoral Area "C". After considering the subject application and the reports, the Board resolved that further consideration of the application be withheld until the applicant has submitted a hydrogeological report that provides an evaluation of how the proposal aligns with the findings and recommendations of the Keddleston Groundwater Study – Phase 2 and which demonstrates:

1. that groundwater sources would be available to service the full buildout potential of the subject property (8 lots) in accordance with the provisions of Subdivision Servicing Bylaw No. 2600; and
2. that the use of the groundwater supplies would not have a negative impact on the use of existing wells that obtain water from Aquifers 349 and 351.

At the Regular Meeting held on March 22, 2023, the Board considered the subject application along with a report from Interior Geoscience Inc. dated January 23, 2023. The report takes into account the Golder Report – Phase 2 and provides a comparison of the findings of the assessment for the subject property against the findings and recommendations contained within the Golder Report. The report from Interior Geoscience Inc. concludes that "groundwater sources are available to service the full buildout potential of eight lots in accordance with the provisions of Subdivision Servicing Bylaw No. 2600, and the use of groundwater supplies for the proposed development at full buildout (8 Lots) will not have a negative impact on the use of existing wells that are completed into Aquifer 351." After considering the application along with the report from Interior Geoscience Inc., the Board resolved to give Second Reading to Zoning Amendment Bylaw No. 2850 and to forward the Bylaw to a Delegated Public Hearing.

DISCUSSION:

The Regional District has commissioned WSP Canada Inc to provide high level comments on whether the information in the hydrogeological reports submitted for in-process land use applications for properties in Electoral Area "C" are generally consistent with the objectives of the proposed changes to the Subdivision Servicing Bylaw for Electoral Area "C", as outlined in Subdivision Servicing Amendment Bylaw No. 2930, 2022.

In March 2023, the Regional District commissioned WSP Canada Inc to provide comments on the above noted Interior Geoscience Inc. hydrogeological report dated January 23, 2023. Staff shared the findings of the review with the applicant. In response, the applicant commissioned Interior Geoscience Inc. to prepare the attached hydrogeological report dated July 18, 2023. The report provides an overview of the additional works that were done to further align the findings of the hydrogeological assessment of the proposed development with the proposed changes to the Subdivision Servicing Bylaw. The report states that the "results of the additional hydrogeological assessment support the conclusions made during the earlier investigations." The report also provides recommendations related to the proposed subdivision, including the following:

1. prior to subdivision approval, a well should be drilled on each lot;

2. each of the new wells should be pump tested for a minimum of 48-72 hours to confirm capacity, with oversight and reporting of the tests provided by a qualified professional;
3. locate wells so that they are at least 50 m from each other and from neighbouring wells, if possible, to minimize the potential for well interference.

Staff recommend that a water supply covenant be registered as a condition of rezoning the property to ensure that wells are drilled and tested on each property at the time of subdivision. This would be supported by the recommendations in the above noted report and by the proposed amendments to the Subdivision Servicing Bylaw which, in its current form, would permit the subdivision of the property based on the submission of a hydrologist report and the registration of a covenant which requires that water supplies be proven at the time of Building Permit. Subdivision Servicing Amendment Bylaw No. 2930, 2022 proposes to amend the Subdivision Servicing Bylaw by removing this as an option for proof of water at the time of subdivision for properties within Electoral Area "C". This option is proposed to be removed for subdivisions in Electoral Area "C" due to concerns related to groundwater availability and sustainability of the resource.

Staff also recommend that the water supply covenant include a condition that would require that each of the new wells be pump tested for a minimum of 72 hours to confirm capacity, that each of the new wells be located so that they are at least 50 m from each other and from neighbouring wells and that an observation well be monitored while the wells that would service the proposed new lots are being pump tested. This would be supported by the recommendations in the above noted report and in part by the proposed amendments to the Subdivision Servicing Bylaw which, in its current form, would require that a 72 hour pump test be conducted for a well completed in a bedrock aquifer and that an observation well be monitored while the wells are being pump tested.

The Board previously resolved to forward Zoning Amendment Bylaw No. 2850 to a Delegated Public Hearing. Should the Board support the above noted recommendation, the Bylaw would be forwarded to a Delegated Public Hearing and a water supply covenant would be required to be registered prior to adoption of Zoning Amendment Bylaw No. 2850 along with the requirement that the applicant make suitable arrangements with the Regional District to provide a public trail that would link McLennan Road through the subject property to the existing Grey Canal Trail.

Submitted by:

Greg Routley
Deputy Planning Manager

Endorsed by:

Rob Smailes, RPP, MCIP
General Manager, Planning and Building

Approved for Inclusion:

David Sewell
Chief Administrative Officer

Interior Geoscience Inc
Anthony Friesen M.Sc., P.Geo
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July 18, 2023
Job Number 2022-006
Viktor Malyakin (Owner)

Technical Memorandum

7500 McLennan Rd.
Vernon BC.
V1B 3S7

Dear Mr. Malyakin,

Re: HYDROGEOLOGICAL ASSESSMENT OF GROUNDWATER SUPPLY IN SUPPORT OF REZONING APPLICATION, AT 7500 MCLENNAN RD, ELECTORAL AREA C, IN THE REGIONAL DISTRICT OF THE NORTH OKAKAGAN.

Introduction

Interior Geoscience Inc. (IGI) was initially retained to complete a hydrogeological assessment of groundwater resources to support an initial two lot subdivision and a groundwater feasibility study in support of a rezoning application that would allow for an additional six lots, at 7500 McLennan Rd in Electoral Area 'C' within the Regional District of the North Okanagan (RDNO). These assessments were completed in April 2022[1] (Attachment E) and December 2022[2], respectively. The general location the proposed development is presented in Figure 1 below. A revised site plan showing the proposed lot lines and location of existing wells is presented as Attachment A.

Both initial assessments were completed in accordance with the applicable RDNO bylaw 2600 section 406 and 407, which pertains to private water sources from proposed subdivisions[3]. Section 406 states that if the proposed water source is a groundwater well then there must be evidence that each well can produce 6,550 litres/day [1.0 Imperial gallons/minute] year-round, that the water be potable, and that the well not interfere with neighbouring wells. Section 407 stipulates, that in cases where proposed lots are 2 ha (4.942

[1] Interior Geoscience (IGI), 2022. Hydrogeological assessment of groundwater supply (well Plate ID 66090) in support of subdivision application, at 7500 McLennan Rd. Electoral Areas C, in the Regional District of the North Okanagan. April. 2022.

[2] Interior Geoscience (IGI), 2022. Hydrogeological Assessment inf Groundwater Supply in support of a rezoning application, at 7500 McLennan Rd, Electoral Area 'C', in the RDNO. December 2022

[3] Regional District of North Okanagan (RDNO). 2013. Subdivision Servicing Bylaw No. 2600, 2013.

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acres) or larger (which applies to this project) a hydrogeological report that addresses general groundwater availability is typically acceptable prior to rezoning approval. Either before or after final subdivision approval, water sources (wells) must still be installed and quantity and potability confirmed, prior to final subdivision and/or a building permit being issued.

Since the completion of these assessments, the RDNO has published a proposed amended bylaw[4] based on the findings/recommendations of a Groundwater Study completed in June 2022 by WSP Canada Inc (WSP) (Previously operating as Golder Associates)[5]. At the request of the RDNO, IGI revised the groundwater feasibility study to address the recommendations in the WSP report (Attachment F).

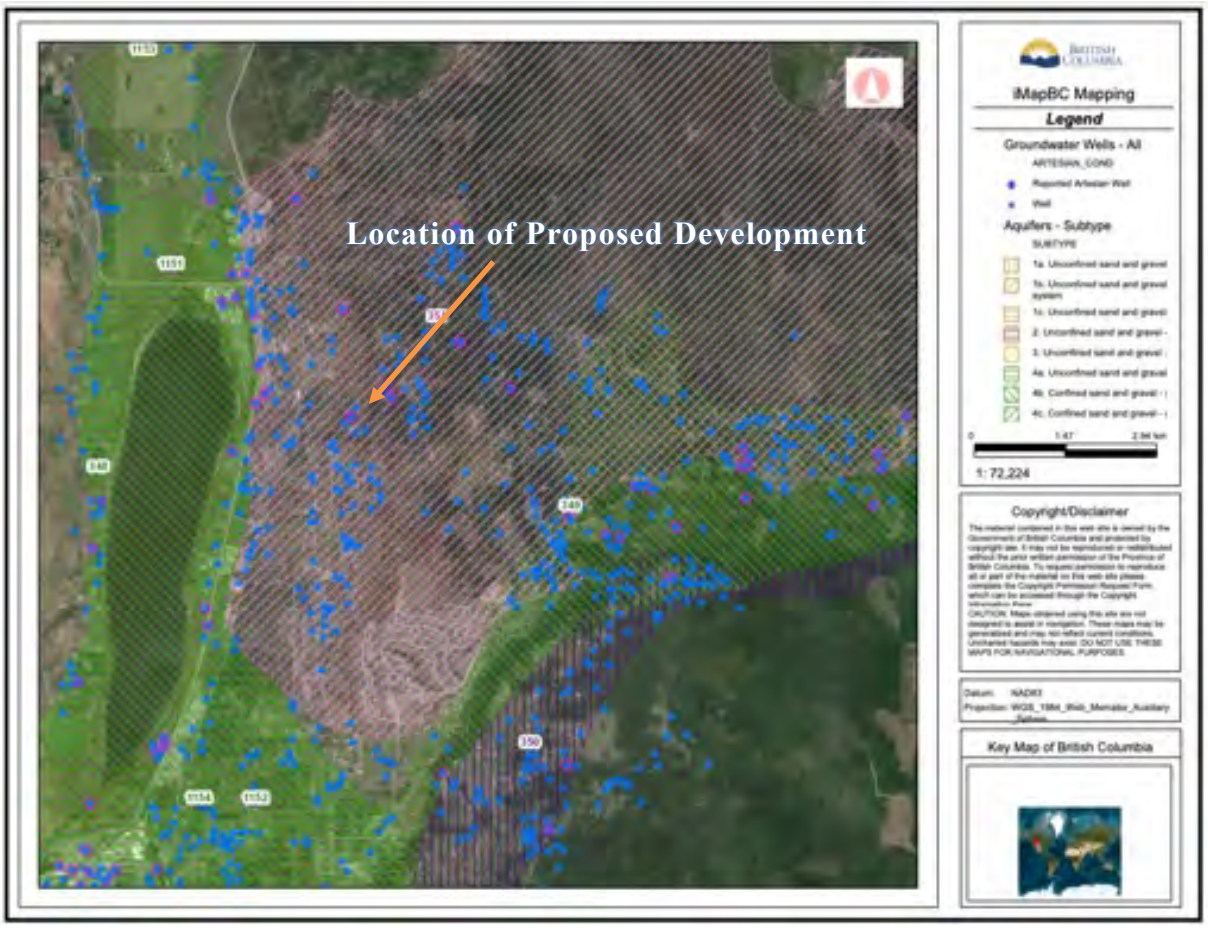

Figure 1: Ima ge showing the Mapped aquifer 351 and wells in relation to the subject site.

[4] Regional District of North Okanagan Subdivision Servicing Amendment Bylaw No. 2930, 2022

[5] Golder Associates. 2022. Report – Keddleston Groundwater Study – Phase 2, Electoral Area C, Regional District of North Okanagan, B.C. 29 June 2022.

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The proposed changes to the Subdivision Servicing Bylaw for Electoral Area “C” in include the following:

- At least one year of continuous groundwater level monitoring be conducted and the results analyzed and interpreted by a Qualified Professional;
- Well pumping tests must be supervised by a Qualified Professional;
- 48-72 hour pumping tests at the current bylaw rate of 6,550 litres of water per day (1.0 Imperial Gallon per Minute) per parcel, depending on the aquifer type;
- Water level recovery must be monitored for the same period of time as the pumping test (48-72 hours) and achieve 90 to 95% recovery;
- At least one observation well must be monitored in the same aquifer and within the same fracture network, during the pumping test and recovery period;
- Pumping tests are to be conducted in the dry months of the year (August 1 st –March 1st);
- Where an application to the RDNO includes more than one proposed lot, the pumping test must be conducted simultaneously at all wells proposed to service each lot;
- A Qualified Professional must submit a signed and stamped hydrogeological report and Schedule A: Qualified Professional - Proof of Water Form, confirming all requirements of the Bylaw have been met.

It is our further understanding that in the spring of 2023 the RDNO retained WSP Canada Inc (WSP) to complete a preliminary third-party review of the previously completed hydrogeological studies for the proposed development and provided comment on whether the IGI reports are consistent with the proposed changes to the subdivision servicing bylaw for the Electoral Area C which has yet to be adopted. Not surprisingly, there were several components of the study’s that do not meet the proposed Bylaw requirements, as it was not intended to. WSP’s comments are attached (Attachment G).

Scope of Work

In response to WSP’s review, and in consultation with the planners at the RDNO, it was decided to complete further study to satisfy some of the additional requirements of proposed bylaw changes to further support the proposed rezoning and development.

Additional scope included the following:

- Review the well logs and confirm that both of the existing wells comply with the minimum standards of the Groundwater Protection Regulation (GWPR) and the Bylaw Amendment,
- Revise the existing site plan of the proposed 8-lot develop to include the location of the existing wells (Attached),

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- Complete a minimum 72-hour pumping test on each of the existing wells located on the subject property,
- Monitored recovery after each of the pumping tests to ensure that water levels in the wells reach 90 to 95% recovery within the same amount of time the well was tested for, and until full recovery was observed,
- Monitoring water level data in at least one, off-site well for the duration of the pumping tests and recovery,
- Monitor water level data in each of the wells for one month after the pumping test,
- Review the pumping test data assess whether each of the wells have a sustainable yield of at least 6550 L/day,
- Complete a technical Memorandum outlining the methods and results of the additional work completed (This document).

Methods

Pumping Tests

To meet the *water supply* requirements of the proposed bylaw amendments, IGI completed two simultaneous pumping test on the two existing wells on the site. Between May 29th and June 1st, Well Plate ID (WPID) 66090 was pumped for 72-hours at a rate of 7.57 L/min (2 USgpm) and WPID 47667 was pumped for 96-hours at a rate of 15.14 L/min (5 USgpm). WPID 47667 was tested for a longer period due to changes in flow rate during the testing period. Although timing did not allow for the pumping tests to be completed between August 1st and March1st as per the requirement of the amended bylaw, this was accounted for in the analysis of the results.

WPID 66090 was tested using the existing pumping that is currently supplying an existing residence, and WPID 47667 was tested using a temporary pump installed three meters above the bottom of the well. The flow rate was controlled with a gate valve on the discharge line. Flow rates were measured using a calibrated pail and stopwatch.

Water depth in each well was measured manually with a water level tape at regular intervals as well as with an automated pressure transducer. Water levels and flow rates were measured and recorded throughout the test, with the most frequent readings made early in the test and again at the beginning of recovery.

During the pumping tests water levels were also monitored in a neighbouring well (WTN 52401) located 270 meters south of WPID 47667 (Figure 2). Attempts were made to monitor other wells in the area, however, due to either a lack of permission, or a lack of access this was not possible at the time. A summary of each of the test parameters is summarized in Table 1 below.

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Table 1: Summary of Pumping test parameters.

Well ID	Discharge Rate Lpm (US gpm)	Test Duration (Hours)	Total Volume of water pumped (Litres)	Depth of Pump (m btoc)
WPID 66090	7.57 (2.0)	72	32,702	118.0
WPID 69447	15.14 (4.0)	96	87,206	146.0

Figure 2: Image showing the site boundaries, proposed lot lines and location of existing wells onsite and the off-site monitoring well.

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Each of the tests were overseen by IGI personnel who remained on site for the duration of each test and collected flow and water level measurements at specified intervals. Water from the test was discharged at a down-slope location approximately 15 m (50 feet) from the well. Following pump shutoff after, water level recovery measurements were collected manually at regular intervals for at least 72 hours after each test, or until 90% recovery was observed. Transducers were deployed in each of the wells to continue monitoring water develops for an additional month after the pumping tests.

Following pumping, the data from each pumping test were analyzed following the methods outlined in the B.C. Certification of Public Convenience and Necessity (CPCN)[6]. This method extrapolates water levels to 100 days and calculates a sustainable pumping rate based on this extrapolation. The sustainable pumping rate is then reduced by a safety factor, often 30%, which is reserved for (1) housing the submersible pump, (2) seasonal and drought water levels that may occur, and (3) accommodating any future drop in well efficiency during operation.

WELL INTERFERENCE AND LONG-TERM GROUNDWATER LEVEL TRENDS

Due to the timeline of the proposed development and the introduction of the amended bylaw, it was not feasible to monitoring the existing wells for a whole year as per the proposed bylaw law amendment. However, pressure transducers were used to monitoring water levels in each of the existing wells during the pumping tests and for over one month after the end of the pumping tests. In addition, water levels in one other off site well (WTN[7] 52401) were recorded manually during the pumping test[8]. Due to either a lack of access, lack of permission, or distance from the pumping wells, no other wells were monitored during this assessment.

Results

Long-Term Well Yield Assessment

WPID 66090
To assess the long-term sustainable yield of the well, WPID 66090 was pumped at a rate of 0.13L/s (2.0 US gpm) for 72-hours, which is equivalent to 1.7 times the long-term bylaw requirement. During this time the well drew down 17.26 m. Table 2 outlines the specifications and results of the pumping test on WPID 66090. Pumping test data and figures showing test

[6] British Columbia Ministry of Environment (MOE). 2007a. Evaluating Long-term Well Capacity for a Certificate of Public Convenience and Necessity: a guidance document. http://www.env.gov.bc.ca/wsd/plan_protect_sustain/ groundwater/library/eval_well/index.html (accessed July 10, 2023).

[7] WTN denotes Well Tag Number, as assigned by the Ministry of Forests
[8] Unfortunately, due to the nature the well, a transducer was not able to be installed and only manual measurement were made during the pumping tests.

results are provided as Attachment B. Based on the CPCN method the sustainable yield was calculated to be an estimated 0.24 L/s (4.0 US gpm), or 20,810 L/day. After adding in a 30% safety factor to account for the seasonal variability in the water levels and well interference a as per the CPCN guidelines, the sustainable pumping rated calculated is 0.17L/s (2.7 US gpm). Or 14,567 L/day (over 2 times the bylaw requirement).

It should be noted that the static water level prior to the pumping test was recorded at 17.98 m below the top of casing (mbtoc). This is significantly lower than the static water level recorded (10.96 mbtoc) prior to the first test completed in March 2022. The likely reason for this is the fact that the first test was completed prior to the wells being used for the existing residence. The pumping results of the initial test completed in 2022 indicated a sustainable yield of 0.14L/sec (12,418 L/day).

WPID 47667
To assess the long-term sustainable yield of the well, WPID 47667 was pumped at a rate of 0.3 L/sec (5 USgpm) for the first 80 minutes, and 0.25L/s (4.0 US gpm) for the remainder of the 96-hour test. This is equivalent to 3.3 times the long-term bylaw requirement. During this time the well drew down 32.42 m. Table 2 outlines the specifications and results of the pumping test on WPID 47667. Pumping test data and figures showing test results are provided in Attachment C. Based on the CPCN method the sustainable yield was calculated to be an estimated 0.29 L/s (5.0 US gpm), or 25,186 L/day. After adding in a 30% safety factor to account for the seasonal variability in the water levels and well interference a as per the CPCN guidelines, the sustainable pumping rated calculated is 0.20L/s (3.2 US gpm). Or 17,630 L/day (2.7 times the bylaw requirement).

Recovery

Recovery data is included in Figures B-1 and C-1 (Attached). WPID 66090 reached 91% within 72 hours after the pump was turned off and WPID 47667 reach 100% within 96 hours of the end of the pumping test, indicated that both wells satisfy the requirement that water levels in the wells reach 90 to 95% recovery within the same amount of time the well was tested for.

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Table 2: Summary of CPCN calculations based on pumping test results.

	WPID 66090	WPID 47667
PUMPING SPECIFICATIONS		
Pumping rate (L/s)	0.13	0.25
Test duration (hours)	72	96
Depth of pump intake (mbtoc)	146.00	65.00
Static water level (mbtoc)	17.98	21.94
Depth to top of primary fracture (mbtoc)	85.30	5.00
Depth of well (mbgl)	152.00	68.58
RECOVERY		
Recovery after 72 and 96 hours (%)	91	100+
Pumping rate (L/s)	0.13	0.25
Available drawdown (m)	66.70	46.64
Drawdown at 100 days (m)	36	40
CPCN OUTPUTS		
100-day specific capacity (L/s/m)	0.004	0.006
Sustainable pumping rate (L/s)	0.24	0.29
Sustainable pumping rate with BC safety factor of 30% (L/s)	0.17	0.20
Sustainable pumping rate (L/d)	20,810	25,186
Sustainable pumping ate with BC safety factor of 30% (L/d)	14,567	17,630
Sustainable pumping rate (USGPM)	4	5
Sustainable pumping rate with BC safety factor of 30% (USGPM)	2.7	3.2

Notes:
1. m btoc = metres below top of casing.
2. The available drawdown is the difference between static water level and depth to the dominant water bearing fracture (85.3 m btoc).
3. The drawdown at 100 days (100-day drawdown) is the extrapolated drawdown in the pumping well.
4. A 30% safety factor was applied to the calculated sustainable pumping rate, as per the CPCN Guideline. This is intended to account for seasonal variability and future wells drilled in the area.

Well Interference

Due to the nature of simultaneous tests, it is difficult to determine the level of influence between the two wells that were being pumped during the pumping test. Furthermore, due to the construction of the neighbouring well used for monitoring, it was decided to not drop either the water level tape or a pressure transducer down the well. As an alternative an acoustic sounder was used to determine water levels throughout the test. Data from monitoring well is presented in Table 3 below and included in the pumping test plots (Figures

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B-1 and C-1, attached). Unfortunately, due to the well being in use for domestic and outdoor use the data is not conclusive. While the pump was running, the drawdown observed in the monitoring well ranged from 3.16 to 5.76 m. During times when the pump was not running, the water level was stable with little to no sign of influence from the subject pumping tests.

Table 3: Summary table of water level data in off-site monitoring well (WTN 52401)

Monitoring Well Water Level Data (WTN 52401)		
Clock Time	Water Level (m)	Comments
5-29-23 12:20 PM	16.72	Water pump off
5-29-23 1:20 PM	16.88	Water pump off
5-29-23 4:20 PM	22.14	Water Pump On
5-29-23 8:20 PM	16.71	Water pump off
5-30-23 8:30 AM	16.61	Water pump off
5-30-23 11:20 AM	18.2	Water pump off
5-30-23 3:20 PM	16.22	Water pump off
5-30-23 7:40 PM	21.45	Water Pump On
5-31-23 10:05 AM	22.11	Water Pump On
5-31-23 6:30 PM	16.12	Water pump off
6-1-23 8:30 AM	18.95	Water pump off
6-1-23 6:30 PM	19.88	Water pump off
6-2-23 9:46 AM	23.04	Water Pump On
6-2-23 7:32 PM	16.7	Water pump off
6-3-23 10:10 AM	17.01	Water pump off
6-4-23 8:42 AM	22.48	Water Pump On
6-5-23 9:34 AM	18.22	Water Pump On

To determine whether water used from any of the existing wells surrounding the proposed development showed any influence on the subject wells, pressure transducers were used to monitoring water levels in the subject wells for one month after the pumping test (Attachment D).

WPID 66090
With the exception of the daily drawdown in response to the domestic demand in WPID 66090 there no evidence of influence between the subject wells and any ongoing water use in any of the neighbouring wells. It should be noted that the significant draw down observed in WPID 66090 approximately 77 hours after the end of the pumping test is due to a combination of refilling the existing homes water cistern, and a hose being unintentionally left on for 47 hours. During this time, it is estimated that between 64,050 and 96,073 liters (two to three times the volume that was pumped during the pumping test) of additional water was discharged. Due to the excess pumping, the water levels dropped below the height of the transducer (approximately 100 m below top of casing). Based on the drawdown trend, we

can estimate that the water level likely dropped to an estimated 113 m btoc, with a total drawdown of 95 meters from the wells original static water level. Once the water was turned off, 90% recovery was reached within 31.5 hours.

WPID 47667
The long-term water level data from WPID 47667 indicate very little to no influence from neighbouring wells or the ongoing pumping in WPID 66090 except for a small change in the recharge rate as indicated on figure D-1 (Attached). This apparent increased rate in recharge loosely coincides with when the WPID 66090 was turned off after it was let run for some time, indicating that there may be some degree of connection. However, when WPID 66090 was under normal use, the water levels in WPID 47667 was observed to be very stable over time.

Conclusions

The results of this additional hydrogeological assessment support the conclusions made during the earlier investigations and, it is reasonable to conclude that groundwater sources are available to service the full buildout potential of eight lots in accordance with the provisions of Subdivision Servicing Bylaw No. 2600, and the use of groundwater supplies for the proposed development at full buildout (8 Lots), will not have a negative impact on the use of existing wells that are completed into Aquifer 351. The following conclusions support this assessment:

- A review of the drillers well logs and observations made of the well head indicate that the subject wells meet the applicable GWPR's.
- WPID 66090 and WPID 47667 were pump tested for a minimum of 72-hours long at rates of 0.13 and 0.25 L/sec respectively and therefore satisfies the bylaw amendment that requires a minimum test length of 48-72 hours at a rate of 0.076 L/sec.
- The results of the pumping test analysis indicate that WPID 66090 has a long-term sustainable yield of 14,567 L/day, respectively, and therefore meets the bylaw requirement of a sustainable yield of 6550 L/day. Comparing the result of this most recent pumping test, to the results of the pumping test, and analysis completed in March of 2022 which rated the well at 12,418L/day, we can conclude that although the pumping test completed during a drier time of year did result in a slightly lower estimate (8.5% difference) of the sustainable yield, the difference is not significant enough to alter the conclusions.
- The results of the pumping test analysis indicate that WPID 47667 has a long-term sustainable yield of and 17,630 L/day which is greater than the required 6550 L/day. If we reduce the sustainable yield an additional 10% to account for the fact that the test was not completed between August 1st and March 1st (15,867 L/day) the well still is more than capacity of meeting the bylaw requirements.

- Using the most conservative values of sustainable yields, the WPID 66090 and 47667 have an estimated yield of 12,418 and 15,867 liters per day. Just these two wells are enough water to supply over half of the eight proposed lots based on the required bylaw amount of 6,550 L/day without having an impact on each other, or any of the neighbouring wells in the area.
- Recovery data indicates that both wells reached at least 90% recovery within the same amount of time that they were pumped for and reached full recovery shortly thereafter.
- WTN 52401 was monitored during the pumping tests and the recovery period. Monitoring data indicate that there is little to no well interference between the two onsite and the neighbouring well that were monitored.
- Long-term monitoring of the pumping wells indicates that over the course of the monitoring period there is little to no apparent interference between the existing wells onsite and the ongoing use occurring in the neighbour wells.
- As concluded in the previous phase of this investigation, the efforts and conclusions of the 2022 Golder report are primarily focused on the areas of Wilson-Jackson-Upper, Keddleston-Clearview Road, and include little evidence to support the conclusions made with respect to the 'Western' (downgradient) portion of Aquifer 351. Although, no doubt there are portions of Aquifer 351, and/or individual wells that may be limited with respect to groundwater availability, the fact that the proposed development is within a separate catchment from the remainder of Aquifer 351, with evidence of highly fractured bedrock as a result of a known fault in the area, suggests that the assumptions that may be applied to some areas of Aquifer 351 are not entirely relevant to the aquifer conditions near the proposed development.

Based on the results of this hydrogeological assessment, IGI provides the following recommendations:

- Permit the subject parcel of land to be rezoned to allow for the potential to develop the land into a maximum buildout of 8 lots, with the understanding that the proposed development will still be required to meet the subdivision servicing bylaw requirements prior to approval.
- Prior to subdivision approval, a well should be drilled on each lot.
- After drilling, well drillers reports should be reviewed by a qualified professional to ensure the well construction meets the GPWR.
- Each of the new wells should be pump tested for a minimum of 48-72 hours to confirm capacity, with oversight and reporting of the test(s) provided by a qualified professional.
- During each pumping test, a water quality sample should be taken to determine whether each well meet the applicable potability standards.
- Locate wells so that they are at least 50 m (165 ft) from each other and from neighbouring wells, if possible, to minimize the potential for well interference; and
- Locate wells at least 30 m (100 ft) from existing or proposed septic tanks and sewage disposal fields.

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Closure

This report was prepared for Victor Malyakin to provide a hydrogeological assessment in support of a rezoning application at 7500 McLennan Road, in the North Okanagan Regional District.

The services provided by Interior Geoscience Inc. The preparation of this report was conducted in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions. No other warranty expressed or implied is made.

Respectfully submitted,

Tony Friesen M.Sc., P.Geo
Hydrogeologist

Permit To Practice Number 1004322

Attachments:

Attachment A – Site Plan showing proposed layout for 8 lots and locations of existing wells
Attachment B – 72-hour pumping test and recovery data and plots for WPID 66090
Attachment C – 96-hour pumping test and recovery data and plots for WPID 47667
Attachment D – Long-Term Monitoring data from WPID 66090 and WPID 47667
Attachment E – Hydrogeological Assessment of Groundwater Supply in support of two lot subdivision application, at 7500 McLennan Rd, Electoral Area 'C' in the RDNO.
Attachment F – Groundwater Feasibility study in support of the rezoning application, at 7500 McLennan Rd, Electoral Area 'C' in the RDNO.
Attachment G – Preliminary Review of the Hydrogeological reports submitted for proposed residential development at 7500 McLennan Rd, RDNO, BC

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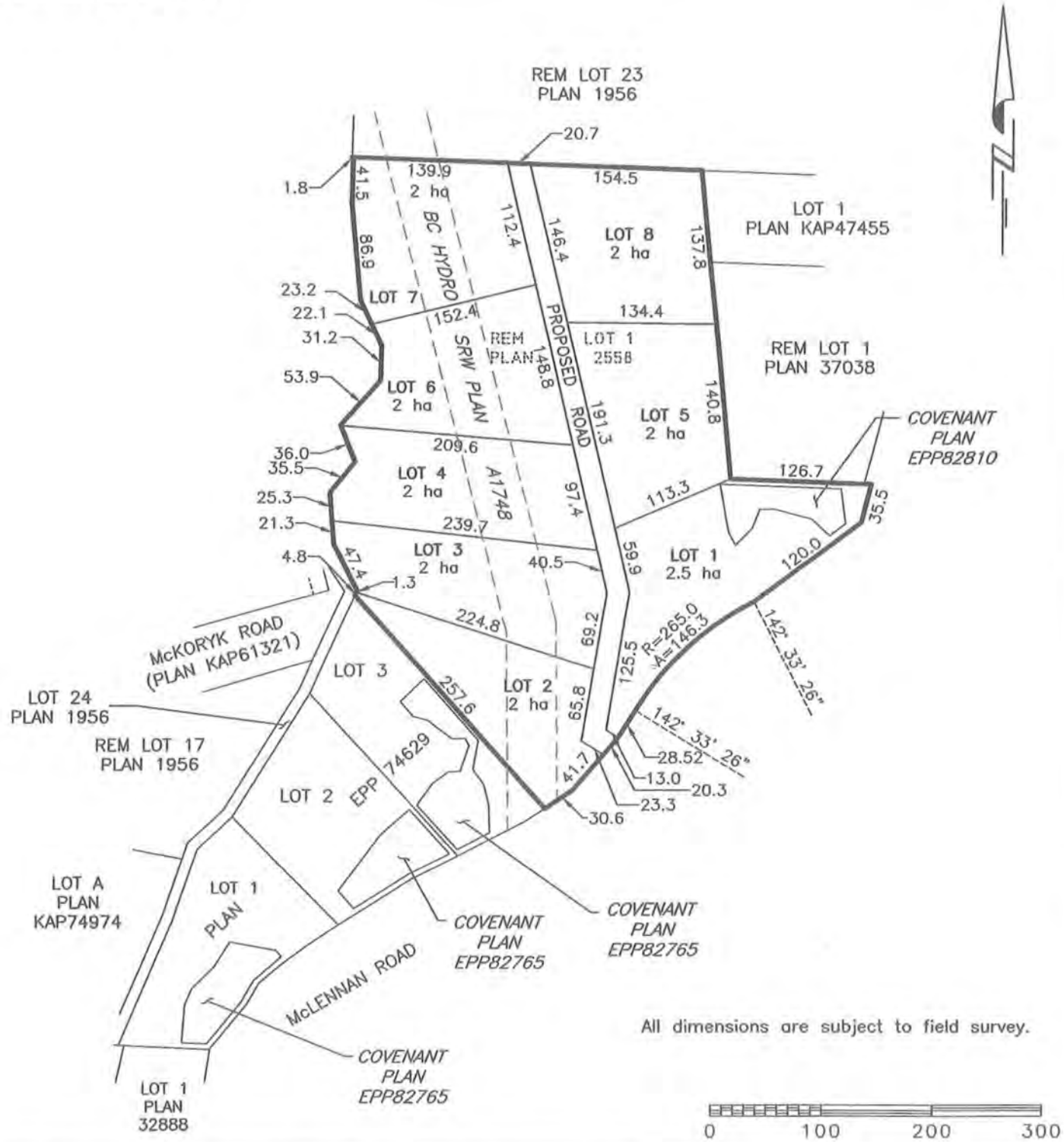
Attachment A – Site Plan showing proposed layout for 8 lots and locations of existing wells.

ALL DISTANCES ARE IN METRES.



PLAN OF PROPOSED REZONING AND SUBDIVISION OF LOT 1, PLAN 2558, SEC 25, TP 8, ODYD EXCEPT PLANS 37038 & EPP74629

106750A01

SCALE: 1 : 5000	OUR FILE: R10675
DATE: 30 Sep 2019	DRAWN: KG

Dacron Enterprises Ltd

MADDOX & COMPANY
LAND SURVEYORS
3500 – 30th STREET
VERNON, BC V1T 5E8
TELEPHONE: (250) 542-4343

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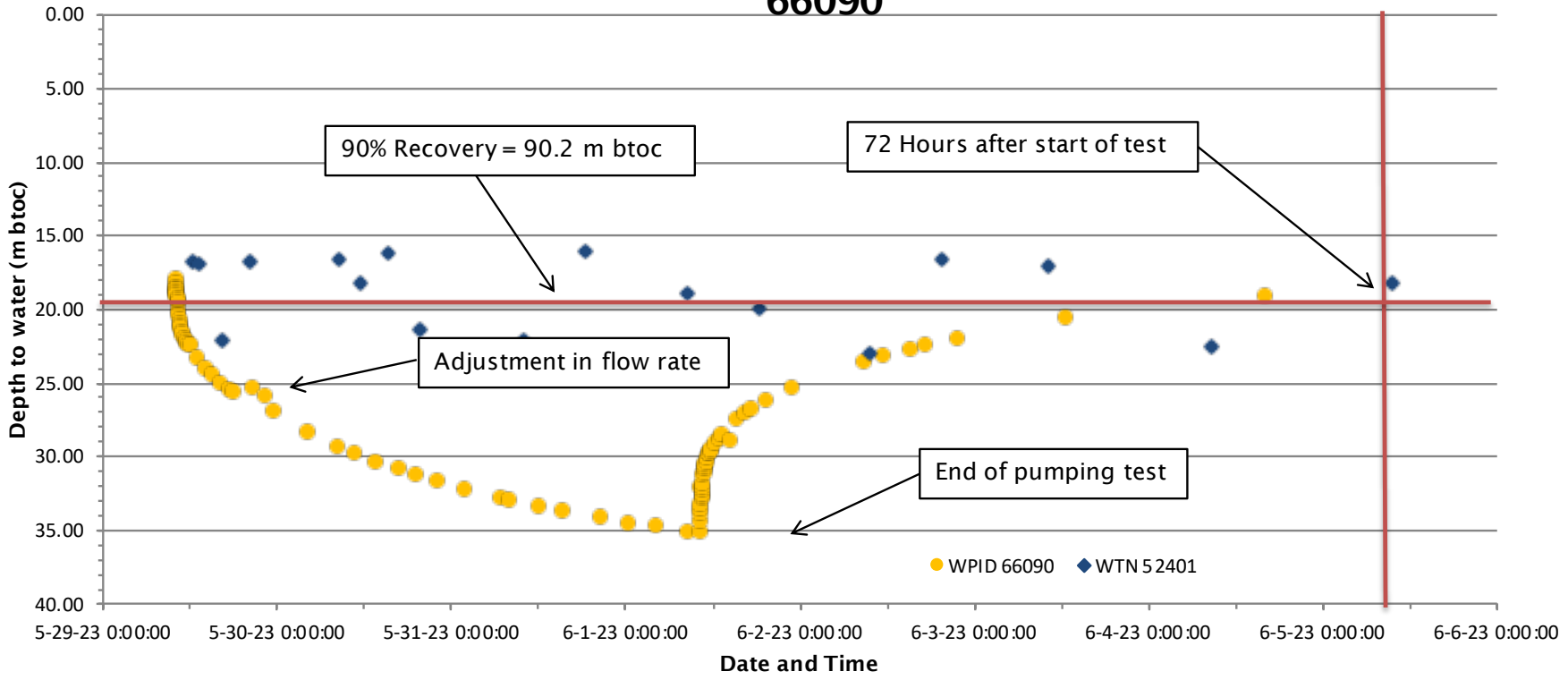
Attachment B – WPID 66090: 72–Hour Constant Rate Pumping Test Data and Data Plots

Project Number	2022-006		Test Type	Constant Rate Test
Client Name	Viktor Malyakin		Test Duration (hours)	72
Hydrogeologist	Tony Friesen		Well Depth (m)	152
Pumping Test Contractor	Interior Geoscience Inc		Static Water Level (mbtoc)	17.98
Location	7500 McLennan Rd		Pump Intake Depth (mbtoc)	146.00
Well Identification	WPID 66090		Pumping Rate (L/s)	0.15
			Test Start Time	5-29-23 10:10 AM
Clock Time	Time Elapsed (min)	Depth to Water (m btoc)	Drawdown (m)	Comments
5-29-23 10:10:00	0	17.98	0.00	Start of Test
5-29-23 10:11:00	1	18.32	0.34	
5-29-23 10:12:00	2	18.56	0.58	
5-29-23 10:13:00	3	18.67	0.69	
5-29-23 10:14:00	4	18.75	0.77	
5-29-23 10:15:00	5	18.92	0.94	
5-29-23 10:16:00	6	19.07	1.09	
5-29-23 10:17:00	7	19.22	1.24	
5-29-23 10:18:00	8	19.35	1.37	
5-29-23 10:19:00	9	19.45	1.47	
5-29-23 10:20:00	10	19.57	1.59	
5-29-23 10:25:00	15	20.14	2.16	
5-29-23 10:30:00	20	20.50	2.52	
5-29-23 10:35:00	25	20.77	2.79	
5-29-23 10:40:00	30	20.99	3.01	
5-29-23 10:45:00	35	21.19	3.21	
5-29-23 10:50:00	40	21.34	3.36	
5-29-23 11:00:00	50	21.59	3.61	
5-29-23 11:10:00	60	21.79	3.81	
5-29-23 11:20:00	70	21.98	4.00	
5-29-23 11:30:00	80	22.13	4.15	
5-29-23 11:40:00	90	22.29	4.31	
5-29-23 11:55:00	105	22.41	4.43	
5-29-23 12:10:00	120	22.51	4.53	
5-29-23 13:10:00	180	23.37	5.39	
5-29-23 14:10:00	240	24.00	6.02	
5-29-23 15:15:00	305	24.53	6.55	Flow observed to be 0.2 US gpm low. Flow Adjusted back to 2.0 Usgpm
5-29-23 16:20:00	370	25.01	7.03	
5-29-23 17:30:00	440	25.45	7.47	
5-29-23 18:00:00	470	25.67	7.69	
5-29-23 20:45:00	635	25.33	7.35	
5-29-23 22:30:00	740	25.99	8.01	
5-29-23 23:30:00	800	26.94	8.96	
5-30-23 4:20:00	1090	28.43	10.45	
5-30-23 8:20:00	1330	29.33	11.35	
5-30-23 10:45:00	1475	29.85	11.87	
5-30-23 13:40:00	1650	30.40	12.42	
5-30-23 16:45:00	1835	30.84	12.86	
5-30-23 19:15:00	1985	31.27	13.29	
5-30-23 22:00:00	2150	31.71	13.73	
5-31-23 2:00:00	2390	32.28	14.30	
5-31-23 6:50:00	2680	32.87	14.89	
5-31-23 8:00:00	2750	32.99	15.01	
5-31-23 12:15:00	3005	33.43	15.45	
5-31-23 15:30:00	3200	33.73	15.75	
5-31-23 20:45:00	3515	34.18	16.20	
6-1-23 0:30:00	3740	34.53	16.55	
6-1-23 4:20:00	3970	34.80	16.82	
6-1-23 8:45:00	4235	35.16	17.18	
6-1-23 10:20:00	4330	35.24	17.26	End of 72-hour test
6-1-23 10:27:00	4337	34.46	16.48	
6-1-23 10:28:00	4338	33.83	15.85	
6-1-23 10:29:00	4339	33.58	15.60	
6-1-23 10:30:00	4340	33.25	15.27	
6-1-23 10:31:00	4341	32.09	14.11	
6-1-23 10:33:00	4343	32.89	14.91	
6-1-23 10:34:00	4344	32.67	14.69	
6-1-23 10:35:00	4345	32.52	14.54	
6-1-23 10:36:00	4346	32.35	14.37	
6-1-23 10:37:00	4347	32.20	14.22	
6-1-23 10:40:00	4350	31.83	13.85	
6-1-23 10:45:00	4355	31.34	13.36	
6-1-23 10:50:00	4360	31.07	13.09	
6-1-23 10:55:00	4365	30.85	12.87	
6-1-23 11:00:00	4370	30.66	12.68	
6-1-23 11:05:00	4375	30.50	12.52	
6-1-23 11:10:00	4380	30.35	12.37	
6-1-23 11:21:00	4391	30.10	12.12	
6-1-23 11:27:00	4397	29.89	11.91	
6-1-23 11:37:00	4407	29.79	11.81	
6-1-23 11:47:00	4417	29.62	11.64	
6-1-23 11:57:00	4427	29.49	11.51	
6-1-23 12:27:00	4457	29.09	11.11	
6-1-23 12:57:00	4487	28.77	10.79	
6-1-23 13:27:00	4517	28.49	10.51	
6-1-23 14:27:00	4577	28.98	11.00	
6-1-23 15:27:00	4637	27.54	9.56	
6-1-23 16:27:00	4697	27.16	9.18	

Project Number	2022-006		Test Type	Constant Rate Test
Client Name	Viktor Malyakin		Test Duration (hours)	72
Hydrogeologist	Tony Friesen		Well Depth (m)	152
Pumping Test Contractor	Interior Geoscience Inc		Static Water Level (mbtoc)	17.98
Location	7500 McLennan Rd		Pump Intake Depth (mbtoc)	146.00
Well Identification	WPID 66090		Pumping Rate (L/s)	0.15
			Test Start Time	5-29-23 10:10 AM
Clock Time	Time Elapsed (min)	Depth to Water (m btoc)	Drawdown (m)	Comments
6-1-23 17:27:00	4757	26.82	8.84	
6-1-23 19:27:00	4877	26.21	8.23	
6-1-23 22:55:00	5085	25.37	7.39	
6-2-23 9:00:00	5690	23.59	5.61	
6-2-23 11:27:00	5837	23.26	5.28	
6-2-23 15:27:00	6077	22.76	4.78	
6-2-23 17:27:00	6197	22.53	4.55	
6-2-23 21:53:00	6463	21.99	4.01	
6-3-23 12:44:00	7354	20.62	2.64	
6-4-23 16:10:00	9000	19.2	1.22	

Figure B-1: Plot of 72-Hour Constant Rate Pumping Data for WPID 66090



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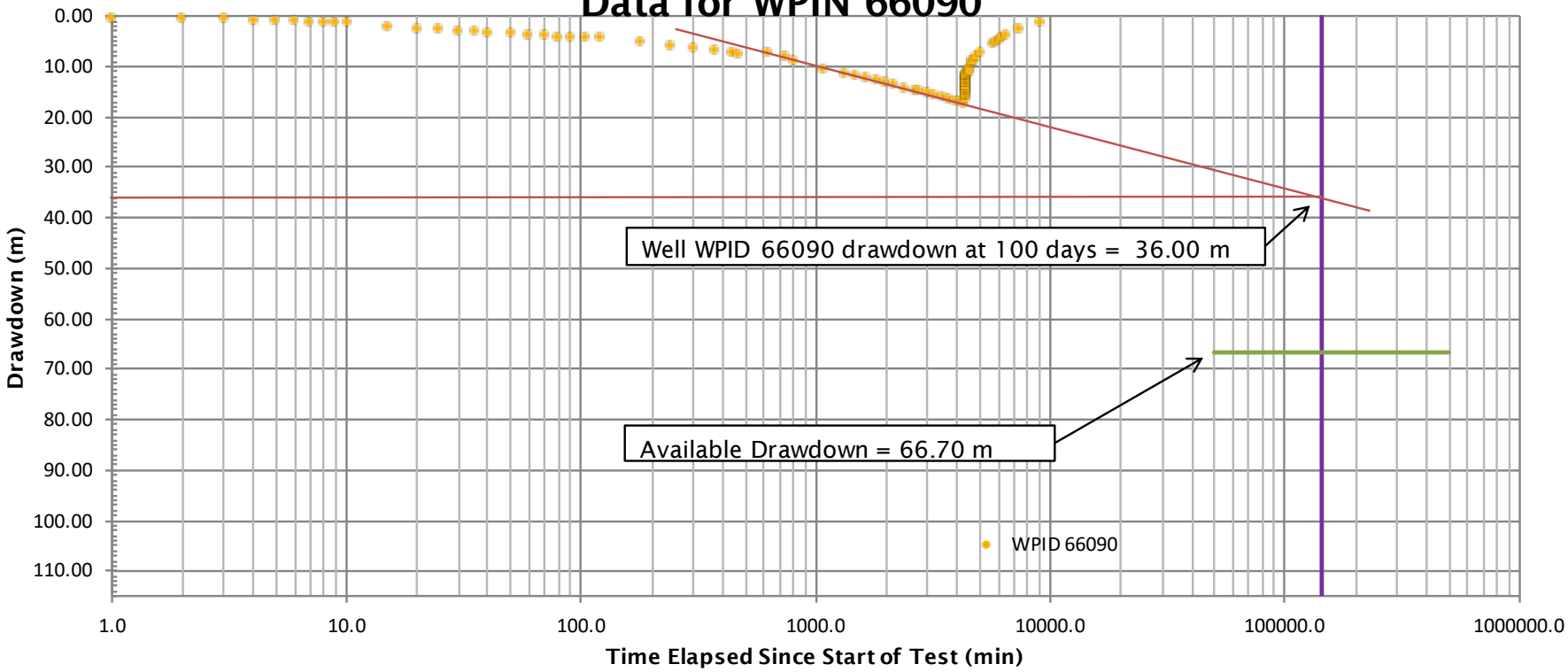
Project Number	2022-006		WPID	66090
Client	Viktor Malyakin		Location	7500 McLennan
Date Drawn:	18-Jul-23		Date of Test	29-May-23
Drawn By:	Tony Friesen		Contractor	IGI

Figure B-2: Semi Log Plot of 72-Hour Constant Rate Pumping Test Data for WPIN 66090



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Project Number	2022-006		WPID	66090
Client	Viktor Malyakin		Location	7500 McLennan
Date Drawn:	18-Jul-23		Date of Test	29-May-23
Drawn By:	Tony Friesen		Contractor	IGI

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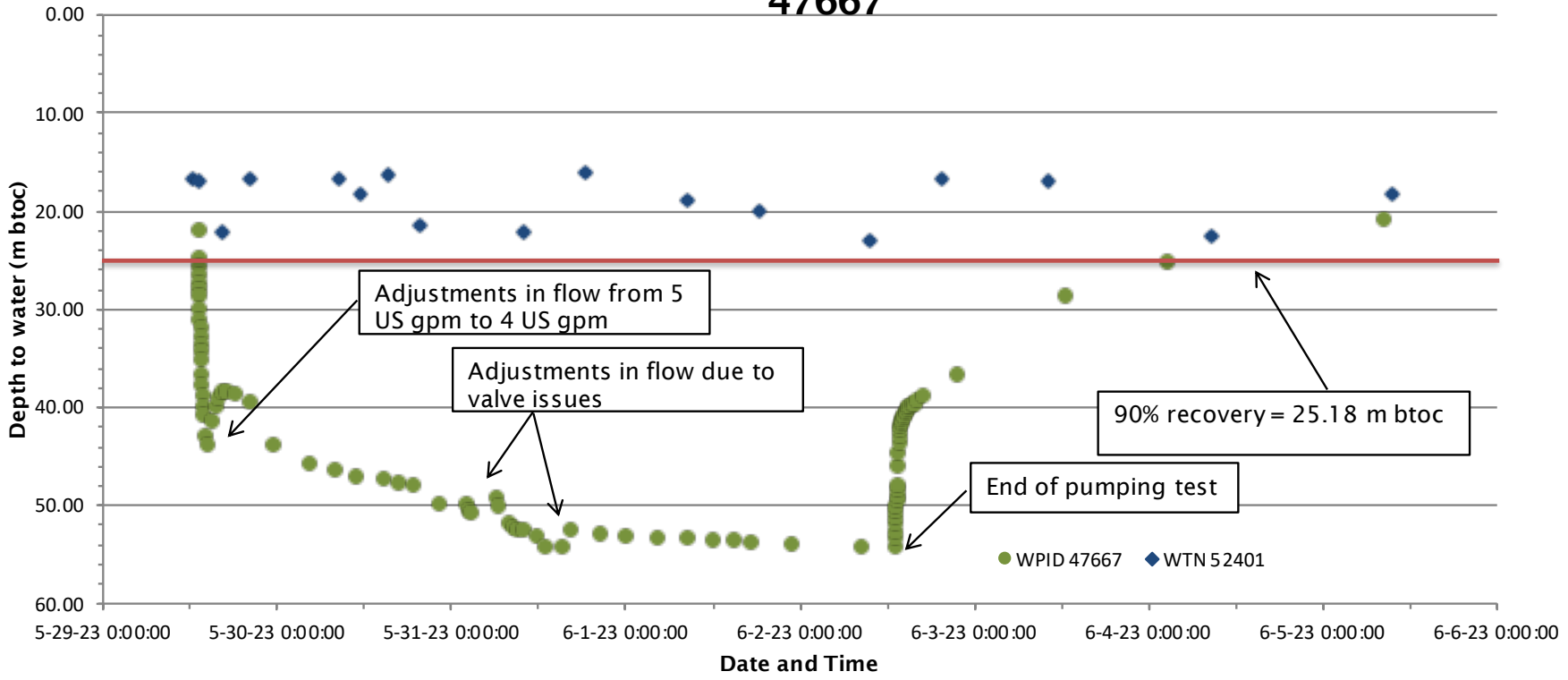
Attachment C – WPID 47667: 96–Hour Constant Rate Pumping Test Data and Data Plots

Project Number	2022-006		Test Type	Constant Rate Test
Client Name	Viktor Malyakin		Test Duration (hours)	96
Hydrogeologist	Tony Friesen		Well Depth (m)	68.58
Pumping Test Contractor	Interior Geoscience Inc		Static Water Level (mbtoc)	21.94
Location	7500 McLennan Rd		Pump Intake Depth (mbtoc)	65.00
Well Identification	WPID 47667		Pumping Rate (L/s)	0.25
			Test Start Time	5-29-23 1:20 PM
Clock Time	Time Elapsed (min)	Depth to Water (m btoc)	Drawdown (m)	Comments
5-29-23 13:20:00	0	21.94	0.00	Start of Test
5-29-23 13:21:00	1	24.76	2.82	
5-29-23 13:22:00	2	25.71	3.77	
5-29-23 13:23:00	3	26.52	4.58	
5-29-23 13:24:00	4	27.44	5.50	
5-29-23 13:25:00	5	28.12	6.18	
5-29-23 13:26:00	6	28.80	6.86	
5-29-23 13:28:00	8	29.95	8.01	
5-29-23 13:30:00	10	31.03	9.09	
5-29-23 13:32:00	12	32.01	10.07	
5-29-23 13:34:00	14	32.91	10.97	
5-29-23 13:32:00	12	33.81	11.87	
5-29-23 13:36:00	16	34.46	12.52	
5-29-23 13:38:00	18	35.15	13.21	
5-29-23 13:40:00	20	36.64	14.70	
5-29-23 13:45:00	25	37.88	15.94	
5-29-23 13:50:00	30	38.99	17.05	
5-29-23 13:55:00	35	39.97	18.03	
5-29-23 14:00:00	40	40.80	18.86	
5-29-23 14:22:00	62	42.99	21.05	
5-29-23 14:40:00	80	43.83	21.89	Changed to 4 US gpm
5-29-23 15:05:00	105	41.60	19.66	
5-29-23 15:35:00	135	39.97	18.03	
5-29-23 16:00:00	160	39.04	17.10	
5-29-23 16:30:00	190	38.43	16.49	
5-29-23 17:15:00	235	38.44	16.50	
5-29-23 18:25:00	305	38.61	16.67	
5-29-23 20:30:00	430	39.61	17.67	
5-29-23 23:33:00	613	43.80	21.86	
5-30-23 4:30:00	910	45.80	23.86	
5-30-23 8:00:00	1120	46.51	24.57	
5-30-23 11:00:00	1300	47.07	25.13	
5-30-23 14:40:00	1520	47.38	25.44	
5-30-23 16:45:00	1645	47.70	25.76	
5-30-23 19:00:00	1780	47.90	25.96	
5-30-23 22:20:00	1980	49.99	28.05	low by .025 Usgpm adjusted up
5-31-23 2:20:00	2220	50.04	28.10	low by 0.3 US gpm
5-31-23 2:33:00	2233	50.62	28.68	4 Usgpm
5-31-23 2:40:00	2240	50.79	28.85	
5-31-23 6:10:00	2450	49.40	27.46	Flow down 0.5 Usgpm
5-31-23 6:40:00	2480	50.25	28.31	
5-31-23 8:10:00	2570	51.90	29.96	
5-31-23 8:45:00	2605	52.37	30.43	
5-31-23 9:20:00	2640	52.60	30.66	
5-31-23 10:00:00	2680	52.63	30.69	4 USgpm
5-31-23 12:00:00	2800	53.10	31.16	
5-31-23 13:00:00	2860	54.20	32.26	4.25
5-31-23 15:30:00	3010	54.30	32.36	
5-31-23 16:30:00	3070	52.46	30.52	
5-31-23 20:30:00	3310	52.97	31.03	
6-1-23 0:15:00	3535	53.19	31.25	
6-1-23 4:30:00	3790	53.36	31.42	
6-1-23 8:30:00	4030	53.45	31.51	
6-1-23 12:00:00	4240	53.61	31.67	
6-1-23 15:00:00	4420	53.69	31.75	
6-1-23 17:30:00	4570	53.80	31.86	
6-1-23 23:05:00	4905	54.04	32.10	
6-2-23 8:40:00	5480	54.35	32.41	
6-2-23 13:20:00	5760	54.36	32.42	End of Pumping Test
6-2-23 13:21:00	5761	53.44	31.50	
6-2-23 13:22:00	5762	52.68	30.74	
6-2-23 13:23:00	5763	52.00	30.06	
6-2-23 13:24:00	5764	51.28	29.34	
6-2-23 13:25:00	5765	50.68	28.74	
6-2-23 13:26:00	5766	50.06	28.12	
6-2-23 13:27:00	5767	49.52	27.58	
6-2-23 13:28:00	5768	49.02	27.08	
6-2-23 13:29:00	5769	48.52	26.58	
6-2-23 13:30:00	5770	48.04	26.10	
6-2-23 13:35:00	5775	46.14	24.2	
6-2-23 13:40:00	5780	44.71	22.77	
6-2-23 13:45:00	5785	43.7	21.76	
6-2-23 13:50:00	5790	42.98	21.04	
6-2-23 13:55:00	5795	42.44	20.5	
6-2-23 14:00:00	5800	42.03	20.09	
6-2-23 14:05:00	5805	41.71	19.77	
6-2-23 14:10:00	5810	41.45	19.51	
6-2-23 14:15:00	5815	41.24	19.3	
6-2-23 14:20:00	5820	41.07	19.13	

Project Number	2022-006		Test Type	Constant Rate Test
Client Name	Viktor Malyakin		Test Duration (hours)	96
Hydrogeologist	Tony Friesen		Well Depth (m)	68.58
Pumping Test Contractor	Interior Geoscience Inc		Static Water Level (mbtoc)	21.94
Location	7500 McLennan Rd		Pump Intake Depth (mbtoc)	65.00
Well Identification	WPID 47667		Pumping Rate (L/s)	0.25
			Test Start Time	5-29-23 1:20 PM
Clock Time	Time Elapsed (min)	Depth to Water (m btoc)	Drawdown (m)	Comments
6-2-23 14:30:00	5830	40.77	18.83	
6-2-23 14:40:00	5840	40.54	18.6	
6-2-23 14:50:00	5850	40.35	18.41	
6-2-23 15:00:00	5860	40.19	18.25	
6-2-23 15:10:00	5870	40.05	18.11	
6-2-23 15:20:00	5880	39.92	17.98	
6-2-23 15:40:00	5900	39.67	17.73	
6-2-23 16:00:00	5920	39.74	17.8	
6-2-23 16:20:00	5940	39.29	17.35	
6-2-23 17:00:00	5980	38.93	16.99	
6-2-23 21:45:00	6265	36.73	14.79	
6-3-23 12:50:00	7170	28.63	6.69	
6-4-23 2:40:00	8000	25.2	3.26	
6-5-23 8:30:00	9790	20.9	-1.04	

Figure C-1: Plot of 96-Hour Constant Rate Pumping Data for WPID 47667



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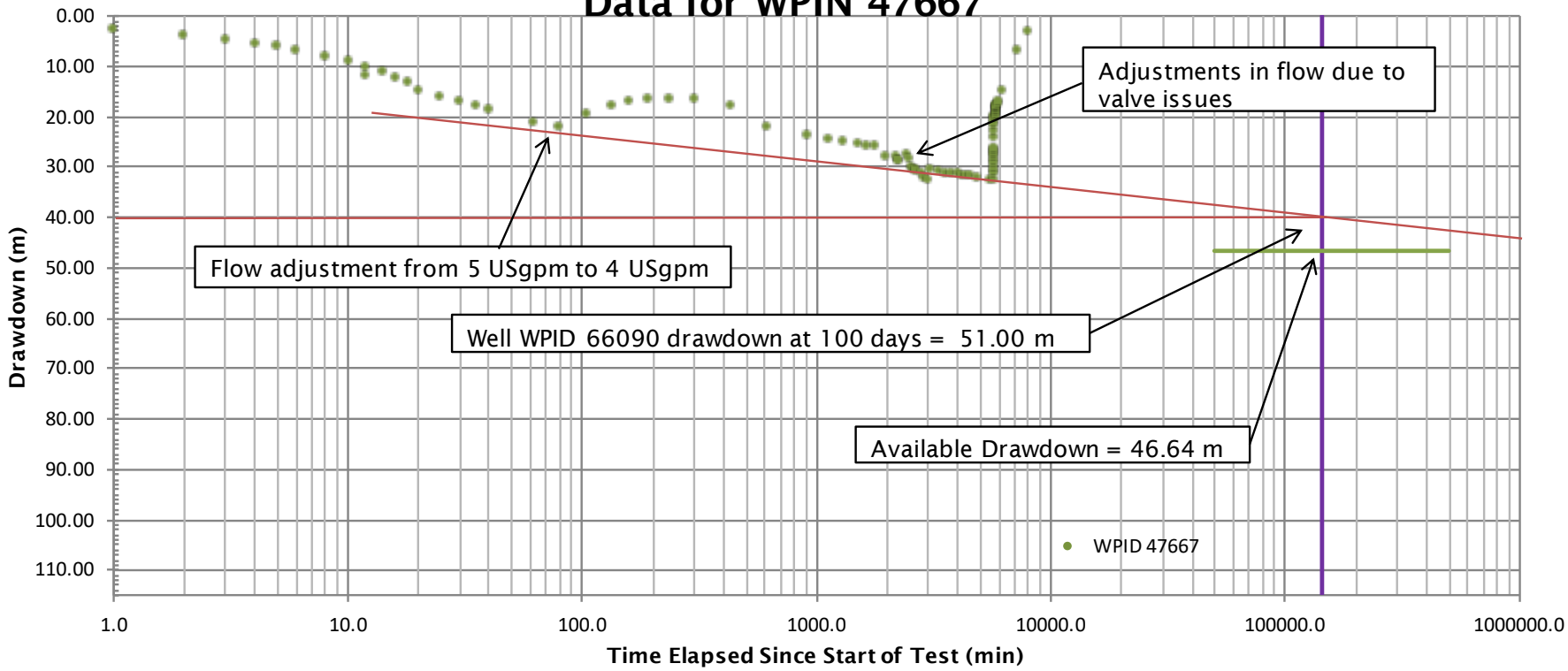
Project Number	2022-006		WPID	47667
Client	Viktor Malyakin		Location	7500 McLennan
Date Drawn:	18-Jul-23		Date of Test	29-May-23
Drawn By:	Tony Friesen		Contractor	IGI

Figure C-2: Semi Log Plot of 96-Hour Constant Rate Pumping Test Data for WPIN 47667



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Project Number	2022-006		WPID	47667
Client	Viktor Malyakin		Location	7500 McLennan
Date Drawn:	18-Jul-23		Date of Test	29-May-23
Drawn By:	Tony Friesen		Contractor	IGI

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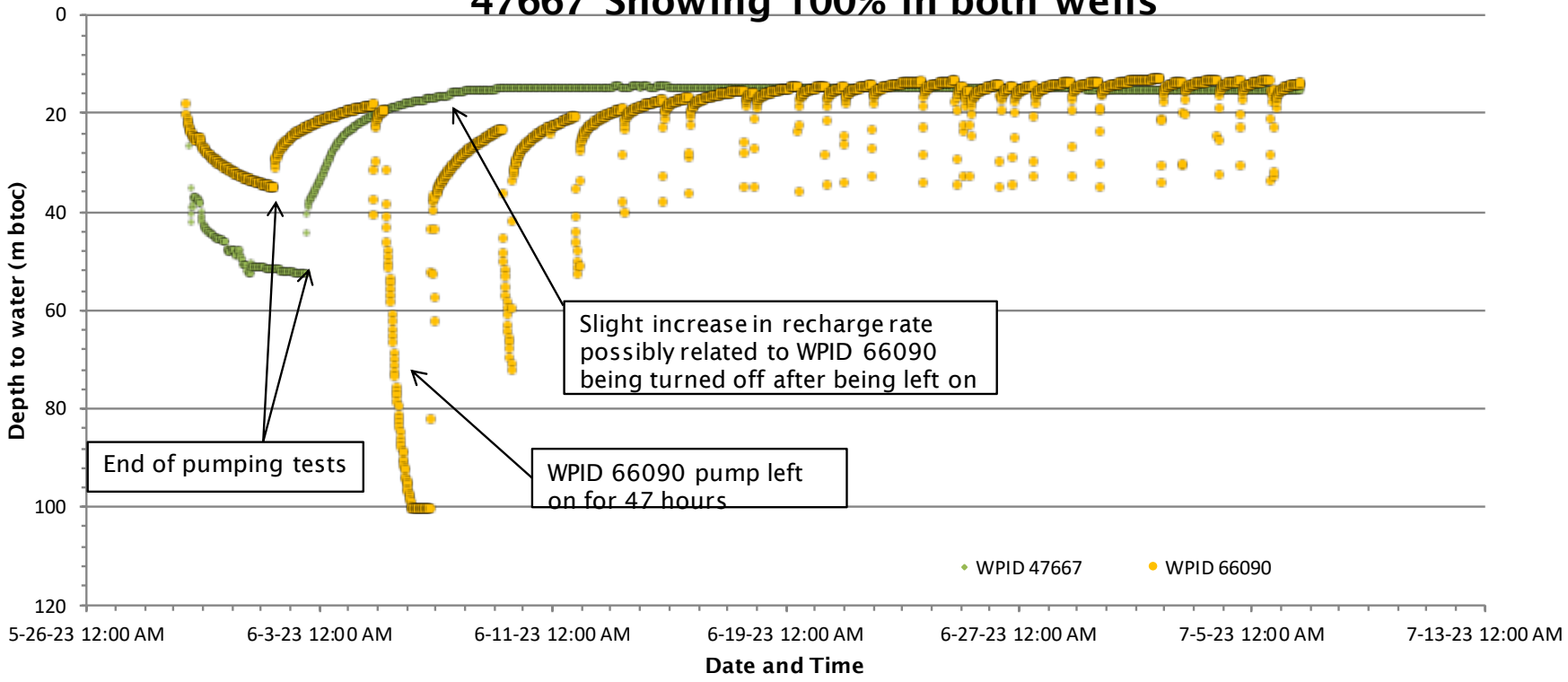
Attachment D – Long-Term Monitoring data from WPID 66090 and WPID 47667

Figure D-1: Long-Term Monitoring Data for WPID 66090 and WPID 47667 Showing 100% in both wells



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Project Number	2022-006		WPID	66090/47667
Client	Viktor Malyakin		Location	7500 McLennan
Date Drawn:	18-Jul-23		Date of Test	29-May-23
Drawn By:	Tony Friesen		Contractor	IGI

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Attachment E – Hydrogeological Assessment of Groundwater Supply in support of two lot subdivision application, at 7500 McLennan Rd, Electoral Area 'C' in the RDNO.

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April 4, 2022
Job Number 2022-006
Viktor Malyakin (Owner)

7500 McLennan Rd.
Vernon BC.
V1B 3S7

Re: HYDROGEOLOGICAL ASSESSMENT OF GROUNDWATER SUPPLY (WELL PLATE ID NUMBER 66090) IN SUPPORT OF SUBDIVISION APPLICATION, AT 7500 MCLENNAN RD, ELECTORAL AREA C, IN THE REGIONAL DISTRICT OF THE NORTH OKAKAGAN.

Dear Viktor,

Interior Geoscience Inc. (IGI) has completed a hydrogeological assessment of one well (WPID 660690) located at 7500 McLennan Rd, near Vernon, BC in Electoral Area "C" of the Regional District of North Okanagan (RDNO). Legal description: Lot 1, Sec 25, Twp 8, ODYD, Plan 2558, Except Plan 37038 and Plan EPP74629. General Location of Proposed subdivision shown in Attachment A.

This report details the findings of our assessment.

1 BACKGROUND AND OBJECTIVES

We understand that you intent to apply to have your 24.21 ha property (Subject Property) subdivided into two lots. Each lot will have its own water supply well. One of the lots will be be serviced by WPID 47667, and the remainder lot will be serviced by well WPID 66090. The driller's well logs are provided in Attachment B.

To complete the subdivision application, the RDNO requires that a hydrogeological assessment be completed and a report (this report) be prepared by a Qualified Professional (QP) and submitted to the Regional District. The preparation of this report was completed by a Proffessional Hydrogeologist registered with Engineers and Geoscientists BC. The hydrogeological assessment is intended to satisfy the applicable sections of the RDNO Subdivision Servicing Bylaw No. 2600, 2013 (the Bylaw) regarding quantity and year-round availability of potable groundwater (RDNO 2013). Section 406-2 of the Bylaw, which deals with groundwater supply and water quality, requires the following conditions:

- A site plan (Attachment C) must be provided indicating the location of a constructed well which must be tested by a well yield test conducted by a Qualified Well Driller,

Qualified Well Pump Installer or a person working under the direct supervision of a Qualified Well Driller, a Qualified Well Pump Installer, or Qualified Professional.

- Groundwater wells that have a reported well yield of left than 14 liter/min (3.7 US gpm) must be tested using a pumping test to show that the well is capable of supplying 4.6 litres/minute (1.2 US gpm) or at least 6,550 litres/day on a year-round basis. The year- round availability of groundwater must consider interference effects on or from nearby wells, and seasonal fluctuations in water level.
- The water must be potable (i.e., safe for human consumption). Water quality samples are to be collected and evaluated against the Canadian Guidelines for Drinking Water Quality (GCDWQ).
- Proof of groundwater quantity and availability must be submitted to the approving officer (RDNO) prior to subdivision approval, in the form of a report by a hydrogeologist or professional engineer.

2 SCOPE OF WORK

To meet the requirements of the Bylaw, IGI completed the hydrogeological assessment, which included the following scope of work:

- **Proof of Water Quantity**: reviewed available geological information for the local area, oversaw a pumping test on WPID 66090 and results were interpreted to estimate the sustainable yield on a year-round basis including assessment of interference effects and seasonal fluctuations in water levels.
- **Proof of water quality**: collected water samples from WPID 66090 and evaluated the water quality results against GCDWQ and assessed water treatment options.
- **Report:** Prepared a report (this document) outlining the methods and results of the hydrogeological assessment to be submitted to RDNO.

3 METHODS

3.1 PROOF OF WATER QUANTITY

IGI first reviewed available climte, hydrogeology, geology, well and aquifer information for the local area to get an understanding of the existing groundwater use in the area and aquifer properties.

3.1.1 Pumping Test

Following the desktop study, on March 16-22, 2022 IGI designed and carried out two constant rate pumping test on WPID 66090. Based on the drillers yield estimate the first test was a 24-hour constant rate test completed at a rate of 9.46 l/minute (2.5 US gpm). At your

request, a second 8.5 hour constant rate was completed at 28.39 l/minute (7.5 US gpm) to help with designing the water distribution system for the home. Discharge rates were controlled with a ball-valve and measured using a calibrated bucket and stop watch. Groundwater was discharged approximately 30 m downgradient using 1-inch garden hose. Groundwater levels were monitored with an electronic well sounder and a water level transducer during pumping and after pump shut-off (recovery) at schedules set by IGI.

The data from both of the pumping tests were interpreted following the methods outlined in the Guidelines for Evaluation Long-Term Well Capacity for a or a Certificate of Public Convenience and Necessity (CPCN) (MOE 2007). This method extrapolates pumping water levels to 100-days and calculates a sustainable pumping rate based on this extrapolated drawdown multiplied by available drawdown. The sustainable pumping rate is then reduced by a safety factor, often 30%, which is reserved for: (1) housing the submersible pump, (2) seasonal and drought water levels that may occur, and (3) accommodating any future drop in well efficiency during operation.

Because the test was completed in March, when groundwater levels are typically higher than in late summer and winter, we also evaluated yearly fluctuations in groundwater levels using data from the nearby Ministry of Environment Observation Well 311, which is approximately 2 km south of the WPID 66090. The observation well has a depth of 94 m bgs and is completed in the same aquifer as the subject well. The groundwater levels in Observation Well 172 indicate an average annual fluxuation of close to 0.5 m and has been incorporated into this analysis.

3.1.2 Well Recovery Test

Water level recovery was monitored after each pumping test every 5 minutes for a minimum of 24-hours after the end of each test. Recovery data was analyzed by a Qualified Professional generally following industry standard practice to determine if recovery was adequate to support the minimum requirement of 6550 L/day.

3.1.3 Well Interference

One way to determine if the proposed water use would have potential adverse effects on neighbouring wells is to monitor the neighbouring wells that are completed nearby the pumping well during the pumping test. A search of the ministry database indicates that there are 21 wells within 0.5 km of the subject well. The nearest wells (WTN 62362 and WTN 49632), are located 98 m northeast and 105 m east of subject well, respectively. An attempt was made to monitor both of these wells, however it was not possible due to access issues and the existing artesian conditions of each of the wells (i.e. the well caps were welded shut to close in head pressure). In lue of this, the secondary well located on the subject property was used as a monitoring well and was recorded every 5 minutes for the duration of both pumping tests, using a programable water level transducer.

3.2 WATER QUALITY

To meet the water quality requirements of the Bylaw, water quality samples were collected during the last 30 minutes of the pumping test as per the British Columbia Field Sampling Manual (MOE 2003). Samples were submitted to CARO Analytical Services (CARO) in Kelowna, BC under Chain of Custody procedures.

RDNO Bylaw 2600 states that the water must be "potable water," which is defined in the Bylaw as "water that meets the microbiological parameters and the health-based chemical and physical parameters of the Guidelines for Canadian Drinking Water Quality" for a select list of parameters. Based on the Bylaw requirements and IGI's recommendations, water samples were analyzed for the following parameters:

- alkalinity
- chloride
- colour
- conductivity
- cyanide (total)
- fluoride
- hardness
- Langelier index
- pH
- nitrate
- nitrite
- sulphate
- total dissolved solids
- turbidity
- *Escherichia coli (E. coli)*
- total coliforms
- metals (total)

The results were compared with the GCDWQ (Health Canada 2020). Guideline levels specified in the GCDWQ are designated as a maximum acceptable concentration (MAC), an aesthetic objective (AO), or an operational guidance (OG). The MAC guidelines are health-risk-based and determined based on the known health effects associated with the substance. The AO guidelines apply to those variables that adversely affect taste or intended, typical water uses (e.g., staining of laundry) but do not pose a health hazard. The OG guidelines apply to parameters that may interfere with water treatment processes.

4 RESULTS

4.1 SITE PHYSIOGRAPHY

The subject site is located the approximately 5 km north of the City of Vernon on the east side of the valley over looking Swan Lake to the west. The property itself is sloped east to west with elevations ranging from 600 m asl on the west boundary to 655 masl at the most eastern point. The site comprises some cleared grassland areas situated between mature forested areas. The land surrounding the subject parcel is primary acerage estates with similar vegetation.

Climate normal data are available for 1981-2010 from the North Vernon climate station (Climate ID 1128583), located at 50º 20'39.600" N and -119º 16' 17.000" W, at an elevation of 538 m asl (Table 1). According to the climate normal data, daily average temperatures range from -2.8 ºC in January to 21.0 ºC in July, with an average annual temperature of 8.8ºC. The average annual precipitation is 487.0 mm, with the majority occurring as snowfall from October to April (142.1 cm) and rainfall year-round (344.9 mm) (ECCC 2022).

Table 1:
Summary of Climate data from Climate Station ID 11258583

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	
Temperature													Yearly Average
Monthly Ave (C°)	-2.8	-0.2	4.2	9.4	13.9	17.4	21.0	20.5	15.3	7.9	1.8	-2.2	8.8
Precipitation													Yearly Total
Rainfall (mm)	11.6	11.7	17.0	27.2	46.3	49.6	35.4	31.9	32.7	40.7	31.1	9.7	344.9
Snowfall (cm)	40.5	13.5	11.7	1.8	0.0	0.0	0.0	0.0	0.0	0.9	26.5	47.3	142.1
Total (mm)	52.2	25.2	28.7	29.0	46.3	49.6	35.4	31.9	32.7	41.5	57.5	57.0	487.0

4.2 GEOLOGY

The subject well on the property is completed in a bedrock formation that is defined as an metamorphic rock within the Silvercreek formation from the proterozoic to Paleozoic period. The formation is described as an undivided quartzfeldpathic gneiss, biotite-quatz schist, (ENV 2022). The overburden at the location of the water supply wells is not mapped; however, available well logs in the area indicate about 10-12 metres of till material above bedrock (ENV 2022).

4.3 AQUIFER AND WELLS

There are two wells on the property. WPID 47667 which is located at the southwest boundary of the parcel, and WPID 66090 (pumping well) which is located at the Southeast corner of the subject parcel of land (Attachment 3). A summary of both wells is presented in table 2 below. Both wells are situated in a mapped aquifer 351, which is a bedrock aquifer, 21.8 km^2 in area with low demand, low vulnerability and low productivity (ENV 2022). Reported well yields range from 0.27 L/s to 0.07 L/s with and average yield of 0.1L/s (compared to the Bylaw rate of 0.076 L/s). The average yield for wells within 500 m of the subject well is 1.17 L/s (15 times the bylaw rate). There no currently records of conflicts between users and the aquifer is described as being not likely hydrualicaly connected to the surface water (ENV 2022).

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Table 2:
Summary of wells located on the Subject Parcel

Well Tag Number	Well Plate ID Number	Finished Well Depth (m)	Static Water Level (m btoc)[1]	Depth to Bedrock	Estimated Well Yield L/sec (US gpm)
125513	66090	152.0	4.36	10.67	0.16 (2.5)
114421	47667	67.10	23.16	5.00	0.315 (5)

There are 21 mapped wells located within 500 m of WPID 66090 (Attachment 4). The nearest wells (WTN 62362 and WTN 49632), are located 98 m northeast and 105 m east of subject well, respectively. An attempt was made to monitor both of these wells, however it was not possible due to access issues and the existing artesian conditions of each of the wells (i.e. the well caps were welded shut to close in head pressure). The artesian conditions at each of these well, and there relative elevation to the subject well (higher) suggests that they are completed into a different fracture network.

In lue of this, the secondary well located on the subject property (WPID 47667) was recorded every 5 minutes for the duration of both pumping tests, using a programable water level transducer.

4.4 PUMPING TEST RESULTS

The first constant rate pumping test was completed at a pumping rate of 0.16 L/s (2.5 US gpm). This was based on the drillers well yield estimate. The well was pumped for 24 hours. Table 3 outlines the specifications and results of the pumping test on WPID 66090. Raw pumping test data, figures showing water levels in pumping wells and observation wells, and drawdown data extrapolated to 100 days are provided in Attachment E. Based on the CPCN method the sustainable yield was calculated to be an estimated 0.21 L/s (3.0 US gpm). To account for th seasonal variability in the water levels and well interference a 30% safety factor as per the CPCN guidelines. After the 30% safety factor was applied, the sustainable pumping rated calculated is 0.14 L/s (2.3 US gpm). Or 12,418 L/day (1.9 times the bylaw requirement).

The second constant rate test was complete at your request to help determine the optimal design for the water supply system for their home and landscaping. The second test was completed at a rate of 0.47 L/sec (7.5 US gpm) for a total of 8.5 hours. Raw pumping test data, figures showing water levels in pumping wells and observation wells, and drawdown data extrapolated to 100 days are provided in Attachment F. Based on the CPCN method the sustainable yield was calculated to be an estimated 0.23 L/s (4.0 US gpm). To account for th seasonal variability in the water levels and well interference a 30% safety factor as per the CPCN guidelines. After the 30% safety factor was applied, the sustainable pumping rated calculated is 0.16 L/s (2.5 US gpm). Or 13,827 L/day (2.1 times the bylaw requirement).

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Table 3:
WTN 66090 long-term CPCN sustainable yield calculations for both constant rate tests.

	WPID 66090	WPID 66090
PUMPING SPECIFICATIONS		
Pumping rate (L/s)	0.16	0.47
Test duration (hours)	24	8.5
Depth of pump intake (mbtoc)	146.00	146.00
Static water level (mbtoc)	10.96	14.33
Depth to top of primary fracture (mbtoc)	85.30	85.30
Depth of well (mbgl)	152.00	152.00
RECOVERY		
Recovery after 24 hours (%)	67	89
Pumping rate (L/s)	0.16	0.47
Available drawdown (m)	66.70	66.70
Drawdown at 100 days (m)	51	138
CPCN OUTPUTS		
100 day specific capacity (L/s/m)	0.003	0.003
Sustainable pumping rate (L/s)	0.21	0.23
Sustainable pumping rate with BC safety factor of 30% (L/s)	0.14	0.16
Sustainable pumping rate (L/d)	17,741	19,752
Sustainable pumping ate with BC safety factor of 30% (L/d)	12,418	13,827
Sustainable pumping rate (USGPM)	3	4
Sustainable pumping rate with BC safety factor of 30% (USGPM)	2.3	2.5

Notes:
1. m btoc = metres below top of casing.
2. The available drawdown is the difference between static water level and depth to the dominant water bearing fracture (85.3 m btoc).
3. The drawdown at 100 days (100-day drawdown) is the extrapolated drawdown in the pumping well.
4. A 30% safety factor was applied to the calculated sustainable pumping rate, as per the CPCN Guideline. This is intended to account for seasonal variability and future wells drilled in the area.

4.5 WELL RECOVERY

A recovery test was completed on the Subject Well after both tests. After the first pumping test, the water levels in the Subject Well were monitored for 48 hours. After 24 hours, the well recovered 67% and after 48 hours the well had recovered to 80% of its original static. It should be noted that twice the bylaw requirement was pumped out over the course of the 24-hours. After the second test the water levels in the Subject Well were monitored for 34 hours. After the second test, the Subject Well reached 89% recovery within 24 hours. The reason for the difference between the two recovery test results is likely due to the fact that the static water level observed prior to the first pumping test is representative of the Subject Well sitting dormant since it was drilled five months earlier. For this assessment, it is more practical to use the lower static water observed prior to the second pumping test since this is likely more representative of the 'operational' static water level once the well is in use. Wells with 85% to 89% recovery are still considered acceptable because of the dual porosity nature of bedrock aquifers; during recovery, the larger, water-bearing fractures account for most of the recovery, whereas the small-scale matrix of the aquifer can take slightly longer to recover (Kruseman and de Ridder 1992).

4.6 WELL INTERFERENCE

The subject wells on the Subject Property are located 300 m apart from each other and groundwater levels in both were monitored during each pumping test. No change in groundwater level was observed in the monitoring well during either of the pumping tests. This indicates that the water bearing factures in each of the wells are either not connected or both the radius of influence fur the duration of the pumping test, and as a result, the sustainable pumping rate is inclusive of this factor.

4.7 WATER QUALITY ASSESSMENT

Water quality results were compared to GCDWQ described as either "maximum acceptable concentrations" (MAC), "aesthetic objectives" (AO) or operational guidance value (OG). The MAC guidelines are health-based and are determined based on the known health effects associated with the substance. The AO guidelines apply to those variables that affect taste or laundry (e.g. by staining), but do not pose a health hazard. The OG guidelines are established based on operational considerations regarding treatment requirements. The laboratory results are included as Attachment G.

There were no exceedances of the MAC indicating the water is potable. However, total dissolved solids (TDS) concentrations exceeded the AO guideline and Turbidity exceeds the operations guidline (Table 4) (Health Canada 2020).

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Table 4:
Concentrations of parameters that exceeded the GCDWQ in WTN 66090

Analyte	Guideline Value	Guideline Type	WTN 66090
Total Dissolved Solids	610	AO	**<500**
Turbidity	12.4	OG	**<1**

Elevated TDS concentrations can be naturally occurring, but can affect taste and cause excessive scaling of water pipes, boilers, and appliances (Health Canada 1991).

The turbidity was high in all nine wells and exceed the GCDWQ operational guidance of 1.0 NTU. In some cases, turbidity is an indication of natural-occurring organic and/or inorganic particles in the water (e.g., metals, organics, and/or microorganisms). It may also be the case that much of the turbidity is a result of residual fines from the drilling process still present in the wells, and these may clean up with additional pumping when the permanent pump is installed. Particles can harbour microorganisms and shield them from disinfection. For operational efficiencies, Health Canada suggests turbidity should be below 1.0 NTU in groundwater but that a responsible party may choose to allow turbidity increases for individual systems, in light of a risk assessment that takes into account local knowledge of the system's capabilities and performance (Health Canada 2012). Turbidity does not have a maximum acceptable concentration (health-based) guideline.

Helpful guidance documents for the treatment of the exceeding parameters are available on Health Canada's website, as follows:

TDS (Health Canada 1991): https://www.canada.ca/en/health-canada/services/publications/healthy-living/guidelines-canadian-drinking-water-quality-guideline-technical-document-total-dissolved-solids-tds.html.

Turbidity (Health Canada 2012): https://www.canada.ca/en/health-canada/services/publications/healthy-living/guidelines-canadian-drinking-water-quality-turbidity.html.

It should be noted that although not in exceedance of the MAC, fluoride concentrations were measured to be equal to the MAC of 1.5 mg/L. Helpful guidance documents for the treatment of flouride are available on Health Canada's website, as follows:

Fluoride (Health Canada 2010): https://www.canada.ca/en/health-canada/services/publications/healthy-living/guidelines-canadian-drinking-water-quality-guideline-technical-document-fluoride.html.

5 CONCLUSIONS AND RECOMMENDATIONS

Based on the results of this hydrogeological assessment, IGI provides the following conclusions:

- The sustainable well yield calculated for Well WTN 66090 based on the 24 hours pumping test (12,418 L/day), meets the Bylaw minimum requirement of 6,550 L/day.
- The recovery in the well was good. Data from the second test indicated 89% recovery within 24 hours after pumping out well over two times the bylaw requirement within 8.5 hours.
- Seasonal fluctuation in water levels and drawdown in neighbouring wells (well interference) was considered when calculating the sustainable yield for both wells and the results indicate that the proposed well use will not interfere with existing users in the area.
- Water quality results indicate that there are no exceedances of the MAC guidelines. However the concentrations of fluoride are at the MAC of 1.5 mg/L.
- Water quality results indicate that the water quality does exceed the AO for TDS and the OG for Turbidity.

Based on the results of this hydrogeological assessment, IGI provides the following recommendations and treatment options:

- Due to the elevated turbidity and TDS in the well, we advise pre-filtering the water using a point of enter system. Once the well have been in use for some time, these parameters can be re-assest to determine if this is still nesseacary.
- Once the well is in operation, complete a water quality test on the well a minimum of once per year to ensure that there is no significant change to the water quality that could result in a health hazard.

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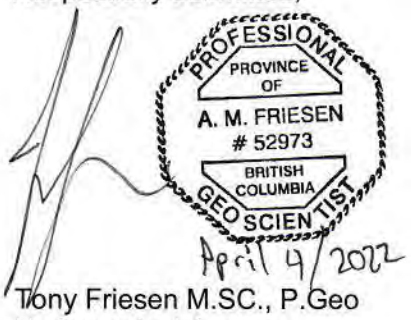
6 CLOSURE

This report was prepared for Victor Malyakin to provide a hydrogeological assessment of WPID 66090 in support of a proposed subdivision application at 7500 McLennan Road, in the Norht Okanagan Regional District.

The services provided by Interior Geoscience Inc. The preparation of this report was conducted in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions. No other warranty expressed or implied is made.

Respectfully submitted,



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Hydrogeologist

Attachments:

Attachment A – Figure showing general location of the Subject Parcel and Aquifer Boundaries.
Attachment B – Drillers Logs for WPID 66090 and WPID 47667.
Attachment C – Site Plan showing location of WPID 66090 and WPID 47667and surrounding wells.
Attachment D – Table Summarizing Wells information within 500 m of WPID 66090
Attachment E – 24-hour pumping test data and Data Plots
Attachment F – 8.5-hour pumping test data and Data Plots
Attachment G – Laboratory reports

References

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Attachment A:
Figure Showing General Location of Subject Property and Aquifer Boundaries.

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Attachment B
Drillers Well Logs for WPID 66090 and WPID 47667

Groundwater Wells and Aquifers

Well Summary

Well Tag Number: 125513
Well Identification Plate Number: 66090
Owner Name: Viktor Malyakin
Intended Water Use: Private Domestic
Artesian Condition: No

Well Status: New
Well Class: Water Supply
Well Subclass: Not Applicable
Aquifer Number:

Observation Well Number:
Observation Well Status:
Environmental Monitoring System (EMS) ID:
Alternative specs submitted: No

Licensing Information

Licensed Status: Unlicensed

Licence Number:

Location Information

Street Address: 7500 McLennan Rd
Town/City: Vernon

Legal Description:

Lot	
Plan	
District Lot	
Block	
Section	
Township	
Range	
Land District	
Property Identification Description (PID)	

Description of Well Location:

Geographic Coordinates - North American Datum of 1983 (NAD 83)
Latitude: 50.33028 **Longitude:** -119.22389
UTM Easting: 341722 **UTM Northing:** 5577719
Zone: 11 **Coordinate Acquisition Code:** (10 m accuracy) Handheld GPS with accuracy of +/- 10 metres

Well Activity

Activity	Work Start Date	Work End Date	Drilling Company	Date Entered
Construction report	2021-10-15	2021-10-22	Integrity Drilling Inc.	April 4th 2022 at 7:16 PM

Well Work Dates

Start Date of Construction	End Date of Construction	Start Date of Alteration	End Date of Alteration	Start Date of Decommission	End Date of Decommission
2021-10-15	2021-10-22				

Well Completion Data

Total Depth Drilled: 500 ft bgl
Finished Well Depth: 500 ft bgl
Final Casing Stick Up: 29 inches
Depth to Bedrock: 34 feet bgl
Ground elevation: 2099 feet

Estimated Well Yield: 2 USgpm
Well Cap: vermine proof
Well Disinfected Status: Disinfected
Drilling Method: Air Rotary
Method of determining elevation: GPS

Static Water Level (BTOC): 120 feet btoc
Artesian Flow:
Artesian Pressure (head):
Artesian Pressure (PSI):
Orientation of Well: VERTICAL

Lithology

From (ft bgl)	To (ft bgl)	Raw Data	Description	Moisture	Colour	Hardness	Observations	Water Bearing Flow Estimate (USGPM)
0	34	til						
34	35	sasnd/gravel						
35	40	light grey bedrock						
40	77	light brn bedrock						
77	80	dark grey bedriock						
80	100	grey		Damp				
100	200	dark grey						1.2
200	220	dark grey						
220	240	dark grey and white		Wet				
240	300	grey						
300	400	grey and white						
400	500	grey and white						0.8

Casing Details

From (ft bgl)	To (ft bgl)	Casing Type	Casing Material	Diameter (in)	Wall Thickness (in)	Drive Shoe
0	35	Surface casing	Steel	6		Installed

Surface Seal and Backfill Details

Surface Seal Material: Bentonite clay
Surface Seal Installation Method: Poured
Surface Seal Thickness: 1 inches
Surface Seal Depth: 15 feet

Backfill Material Above Surface Seal:
Backfill Depth:

Liner Details

Liner Material: PVC
Liner Diameter: 5 inches
Liner from: 10 (ft bgl)

Liner Thickness:
Liner to: 500 (ft bgl)

Liner perforations

From (ft bgl)	To (ft bgl)
170	175
270	275
370	375
470	475

Screen Details

Intake Method:
Type:
Material:
Opening:
Bottom:

Installed Screens

From (ft bgl)	To (ft bgl)	Diameter (in)	Assembly Type	Slot Size
There are no records to show				

Well Development

Developed by: Air lifting

Development Total Duration: 3 hours

Well Yield

Estimation Method: Air Lifting
Estimation Rate: 2 USgpm
Estimation Duration: 2 hours
Static Water Level Before Test: 120 ft (btoc)
Drawdown: 500 ft (btoc)
Hydrofracturing Performed: Yes
Increase in Yield Due to Hydrofracturing:

Well Decommission Information

Reason for Decommission:
Method of Decommission:
Sealant Material:
Backfill Material:
Decommission Details:

Comments

No comments submitted

Alternative Specs Submitted: Yes

Documents

No additional documentation available for this well.

Disclaimer

BRITISH COLUMBIA
Ministry of Environment

☑ **Well Construction Report**
☐ **Well Closure Report**
☐ **Well Alteration Report**

Dan-Gare Drilling
Stamp company name/address/ phone/fax/e-mail here, if desired.

Ministry Well ID Plate Number: 47667
Ministry Well Tag Number: 114421
☐ Confirmation/alternative specs. attached
☐ Original well construction report attached

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

Owner name: Dacron Enterprises Ltd.
Mailing address: 7566 McLennan Rd. Town Vernon Prov. B.C. Postal Code
Well Location: Address: Street no. 7566 Street name McLennan Rd. Town Vernon
(or) **Legal description:** Lot 4 Plan D.L. Block Sec. Twp. Rg. Land District
(or) **PID:** (and) **Description of well location (attach sketch, if nec.):** Lot 4 of Proposed subdivision of 7566 McLennan Rd.
NAD 83: Zone: 11U (see note 2) (and) **UTM Northing:** 634/434 m (or) **Latitude (see note 3):**
UTM Easting: 5577576 m **Longitude:**
Method of drilling: ☑ air rotary ☐ cable tool ☐ mud rotary ☐ auger ☐ driving ☐ jetting ☐ excavating ☐ other (specify):
Orientation of well: ☑ vertical ☐ horizontal Ground elevation: 1964 ft (asl) Method (see note 4): GPS
Class of well (see note 5): Water Supply **Sub-class of well:** 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	5		Brown	Clay & Rocks		
5	220		White	Bedrock		
180	220			Bedrock	5	
						Recommended Pump Setting 200'

Casing details

From ft (bgl)	To ft (bgl)	Dia in	Casing Material / Open Hole	Wall Thickness in	Drive Shoe
+2	16	6	Steel	.219	Yes

Screen details

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

Surface seal: Type: Bentonite Depth: 16 ft
Method of installation: ☐ Poured ☐ Pumped Thickness: 1 in
Backfill: Type: Depth: ft
Liner: ☐ PVC ☐ Other (specify):
Diameter: 4 in Thickness: .250 in
From: 6 ft (bgl) To: 220 ft (bgl) Perforated: From: 180 ft (bgl) To: 220 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:

Well yield estimated by:

☐ Pumping ☐ Air lifting ☐ Bailing ☐ Other (specify):
Rate: 5 USgpm Duration: hrs
SWL before test: ft (btoc) Pumping water level: ft (btoc)

Obvious water quality characteristics:

☐ Fresh ☐ Salty ☐ Clear ☐ Cloudy ☐ Sediment ☐ Gas
Colour/odour: No Water sample collected: ☑

Well driller (print clearly):

Name (first, last) (see note 19): Logan Flett
Registration no. (see note 20): 08042501
Consultant (if applicable; name and company):

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 Logan Flett

Final well completion data:

Total depth drilled: 220 ft Finished well depth: 220 ft (bgl)
Final stick up: 24 in Depth to bedrock: 5 ft (bgl)
SWL: 76 ft (btoc) Estimated well yield: 5 USgpm
Artesian flow: USgpm, or Artesian pressure: ft
Type of well cap: Aluminum Well disinfected: ☑ Yes ☐ No
Where well ID plate is attached: Stick-up

Well closure information:

Reason for closure:
Method of closure: ☐ Poured ☐ Pumped
Sealant material: Backfill material:
Details of closure (see note 17):

Date of work (YYYY/MM/DD):

Started: 2017/08/28 **Completed:** 2017/09/29
Comments:

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

Sheet ____ of ____

Well Completion Data

Total Depth Drilled: 500 ft bgl
Finished Well Depth: 500 ft bgl
Final Casing Stick Up: 29 inches
Depth to Bedrock: 34 feet bgl
Ground elevation: 2099 feet

Estimated Well Yield: 2 USgpm
Well Cap: vermine proof
Well Disinfected Status: Disinfected
Drilling Method: Air Rotary
Method of determining elevation: GPS

Static Water Level (BTOC): 120 feet btoc
Artesian Flow:
Artesian Pressure (head):
Artesian Pressure (PSI):
Orientation of Well: VERTICAL

Lithology

From (ft bgl)	To (ft bgl)	Raw Data	Description	Moisture	Colour	Hardness	Observations	Water Bearing Flow Estimate (USGPM)
0	34	til						
34	35	sasnd/gravel						
35	40	light grey bedrock						
40	77	light brn bedrock						
77	80	dark grey bedriock						
80	100	grey		Damp				
100	200	dark grey						1.2
200	220	dark grey						
220	240	dark grey and white		Wet				
240	300	grey						
300	400	grey and white						
400	500	grey and white						0.8

Casing Details

From (ft bgl)	To (ft bgl)	Casing Type	Casing Material	Diameter (in)	Wall Thickness (in)	Drive Shoe
0	35	Surface casing	Steel	6		Installed

Surface Seal and Backfill Details

Surface Seal Material: Bentonite clay
Surface Seal Installation Method: Poured
Surface Seal Thickness: 1 inches
Surface Seal Depth: 15 feet

Backfill Material Above Surface Seal:
Backfill Depth:

Liner Details

Liner Material: PVC
Liner Diameter: 5 inches
Liner from: 10 (ft bgl)

Liner Thickness:
Liner to: 500 (ft bgl)

Liner perforations

From (ft bgl)	To (ft bgl)
170	175
270	275
370	375
470	475

Screen Details

Intake Method:
Type:
Material:
Opening:
Bottom:

Installed Screens

From (ft bgl)	To (ft bgl)	Diameter (in)	Assembly Type	Slot Size
There are no records to show				

Well Development

Developed by: Air lifting

Development Total Duration: 3 hours

Well Yield

Estimation Method: Air Lifting
Estimation Rate: 2 USgpm
Estimation Duration: 2 hours
Static Water Level Before Test: 120 ft (btoc)
Drawdown: 500 ft (btoc)
Hydrofracturing Performed: Yes
Increase in Yield Due to Hydrofracturing:

Well Decommission Information

Reason for Decommission:
Method of Decommission:
Sealant Material:
Backfill Material:
Decommission Details:

Comments

No comments submitted

Alternative Specs Submitted: Yes

Documents

No additional documentation available for this well.

Disclaimer

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Attachment C
Figure Showing Property Boundaries and Locations of WPID 66090, WPID 47667 and Surrounding Wells

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Attachment D

Table Summarizing Wells information within 500 m of WPID 66090

Well Tag Number	Well Plate ID Number	Finished Well Depth (m)	Static Water Level (m btoc)[1]	Depth to Bedrock	Estimated Well Yield L/sec (US gpm)
124356	62172	153.3144	24.0792	18	4.41 (70)
113890	47649	182.88	31.0896	30	0.2835 (4.5)
111905	39422	128.016	30.7848	7	1.89 (30)
111902	39421	121.92	31.0896	14	0.63 (10)
120202	50399	73.152	19.14144	18	0.189 (3)
120193	50393	91.44	19.5834	6	0.63 (10)
120201	50398	103.632	20.1168	16	0.0945 (1.5)
120195	50395	110.3376	NA	10	0.1575 (2.5)
114421	47667	67.056	23.1648	5	0.315 (5)
109890	38543	54.864	14.9352	3	0.567 (9)
120196	50396	68.8848	0.9144	7	6.3 (100)
120198	50397	79.248	3.6576	21	0.504 (8)
109891	38542	67.056	11.8872	78	1.89 (30)
109892	38541	60.96	6.096	47	0.819 (13)
109889	38544	103.632	33.8328	38	0.0945 (1.5)
113891	47647	140.208	28.3464	na	0.378 (6)
113933	47648	54.864	NA	12	0.315 (5)
52401	NA	48.768	NA	NA	0.378 (6)
49633	NA	73.152	NA	0	NA
49632	NA	64.008	NA	6	3.15 (50)
62362	NA	93.8784	NA	NA	0.315 (5)

Notes:
m btoc – metres below top of casing

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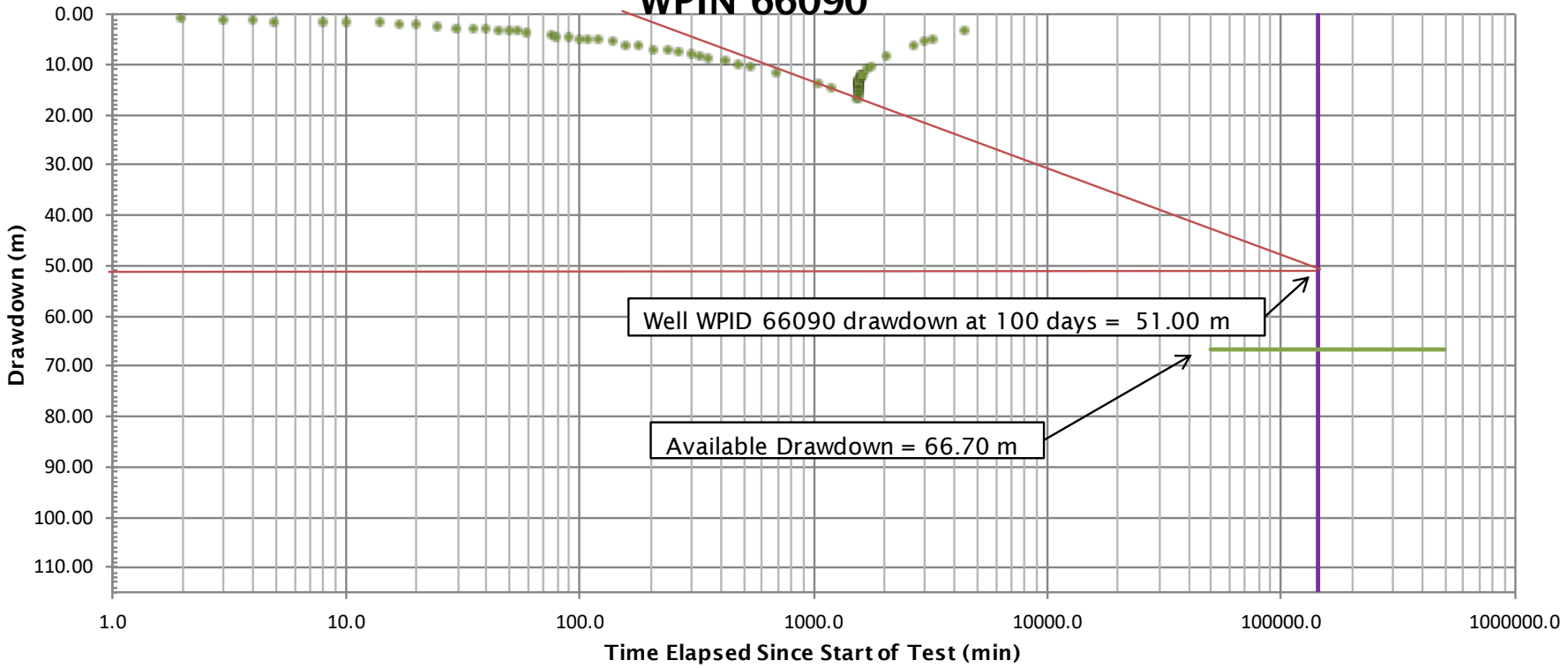
Attachment E
24- Hour Constant Rate Pumping Test Data and Data Plots

Project Number	2022-006		Test Type	Constant Rate Test
Client Name	Viktor Malyakin		Test Duration (hours)	24
Hydrogeologist	Tony Friesen		Well Depth (m)	152
Pumping Test Contractor	Moores Well and Pump		Static Water Level (mbtoc)	10.96
Location	7500 McLennan Rd		Pump Intake Depth (mbtoc)	146.00
Well Identification	WPID 66090		Pumping Rate (L/s)	0.16
			Test Start Time	3-16-22 11:15 AM
Clock Time	Time Elapsed (min)	Depth to Water (m btoc)	Drawdown (m)	Comments
3-16-22 11:15:00	0	10.96	0.00	Start of Test
3-16-22 11:16:00	1	11.90		
3-16-22 11:17:00	2	12.10	1.14	
3-16-22 11:18:00	3	12.34	1.38	
3-16-22 11:19:00	4	12.43	1.47	
3-16-22 11:20:00	5	12.60	1.64	
3-16-22 11:21:00	6		-10.96	
3-16-22 11:22:00	7		-10.96	
3-16-22 11:23:00	8	12.65	1.69	
3-16-22 11:24:00	9		-10.96	
3-16-22 11:25:00	10	12.74	1.78	
3-16-22 11:27:00	12		-10.96	
3-16-22 11:29:00	14	12.95	1.99	
3-16-22 11:31:00	16		-10.96	
3-16-22 11:32:00	17	13.10	2.14	
3-16-22 11:35:00	20	13.35	2.39	
3-16-22 11:40:00	25	13.69	2.73	
3-16-22 11:45:00	30	13.93	2.97	
3-16-22 11:50:00	35	14.08	3.12	
3-16-22 11:55:00	40	14.21	3.25	
3-16-22 12:00:00	45	14.34	3.38	
3-16-22 12:05:00	50	14.45	3.49	
3-16-22 12:10:00	55	14.54	3.58	
3-16-22 12:15:00	60	14.75	3.79	
3-16-22 12:32:00	77	15.51	4.55	
3-16-22 12:35:00	80	15.56	4.60	
3-16-22 12:45:00	90	15.82	4.86	
3-16-22 12:55:00	100	15.97	5.01	
3-16-22 13:05:00	110	16.13	5.17	
3-16-22 13:15:00	120	16.31	5.35	
3-16-22 13:35:00	140	16.64	5.68	
3-16-22 13:55:00	160	17.22	6.26	
3-16-22 14:15:00	180	17.58	6.62	
3-16-22 14:45:00	210	18.04	7.08	
3-16-22 15:15:00	240	18.42	7.46	
3-16-22 15:45:00	270	18.82	7.86	
3-16-22 16:15:00	300	19.14	8.18	
3-16-22 16:45:00	330	19.36	8.40	
3-16-22 17:15:00	360	19.79	8.83	
3-16-22 18:15:00	420	20.42	9.46	
3-16-22 19:15:00	480	21.03	10.07	
3-16-22 20:15:00	540	21.58	10.62	
3-16-22 22:55:00	700	22.78	11.82	
3-17-22 4:45:00	1050	25.08	14.12	
3-17-22 7:15:00	1200	26.02	15.06	
3-17-22 13:00:00	1545	27.73	16.77	
3-17-22 13:15:00	1560	27.74	16.78	
3-17-22 13:16:00	1561	27.17	16.21	Pump Shut off
3-17-22 13:17:00	1562	26.79	15.83	
3-17-22 13:18:00	1563	26.40	15.44	
3-17-22 13:19:00	1564	26.11	15.15	
3-17-22 13:20:00	1565	25.86	14.90	
3-17-22 13:21:00	1566	25.65	14.69	
3-17-22 13:22:00	1567	25.45	14.49	
3-17-22 13:23:00	1568	25.29	14.33	
3-17-22 13:24:00	1569	25.16	14.20	
3-17-22 13:25:00	1570	25.05	14.09	
3-17-22 13:27:00	1572	24.86	13.90	
3-17-22 13:29:00	1574	24.73	13.77	
3-17-22 13:31:00	1576	24.60	13.64	
3-17-22 13:33:00	1578	24.51	13.55	
3-17-22 13:35:00	1580	24.42	13.46	
3-17-22 13:40:00	1585	24.02	13.06	
3-17-22 13:45:00	1590		-10.96	
3-17-22 13:50:00	1595		-10.96	
3-17-22 13:55:00	1600	23.75	12.79	
3-17-22 14:00:00	1605	23.66	12.70	
3-17-22 14:05:00	1610	23.58	12.62	
3-17-22 14:10:00	1615	23.49	12.53	
3-17-22 14:15:00	1620	23.41	12.45	
3-17-22 14:25:00	1630	23.25	12.29	
3-17-22 15:45:00	1710	21.97	11.01	
3-17-22 16:55:00	1780	21.7	10.74	
3-17-22 22:00:00	2085	19.44	8.48	
3-18-22 8:30:00	2715	17.2	6.24	
3-18-22 13:52:00	3037	16.47	5.51	Around 24 hours after shut off
3-18-22 17:58:00	3283	15.95	4.99	
3-19-22 14:00:00	4485	14.33	3.37	

Semi Log Plot of 24-Hour Constant Rate Pumping Test Data for WPIN 66090



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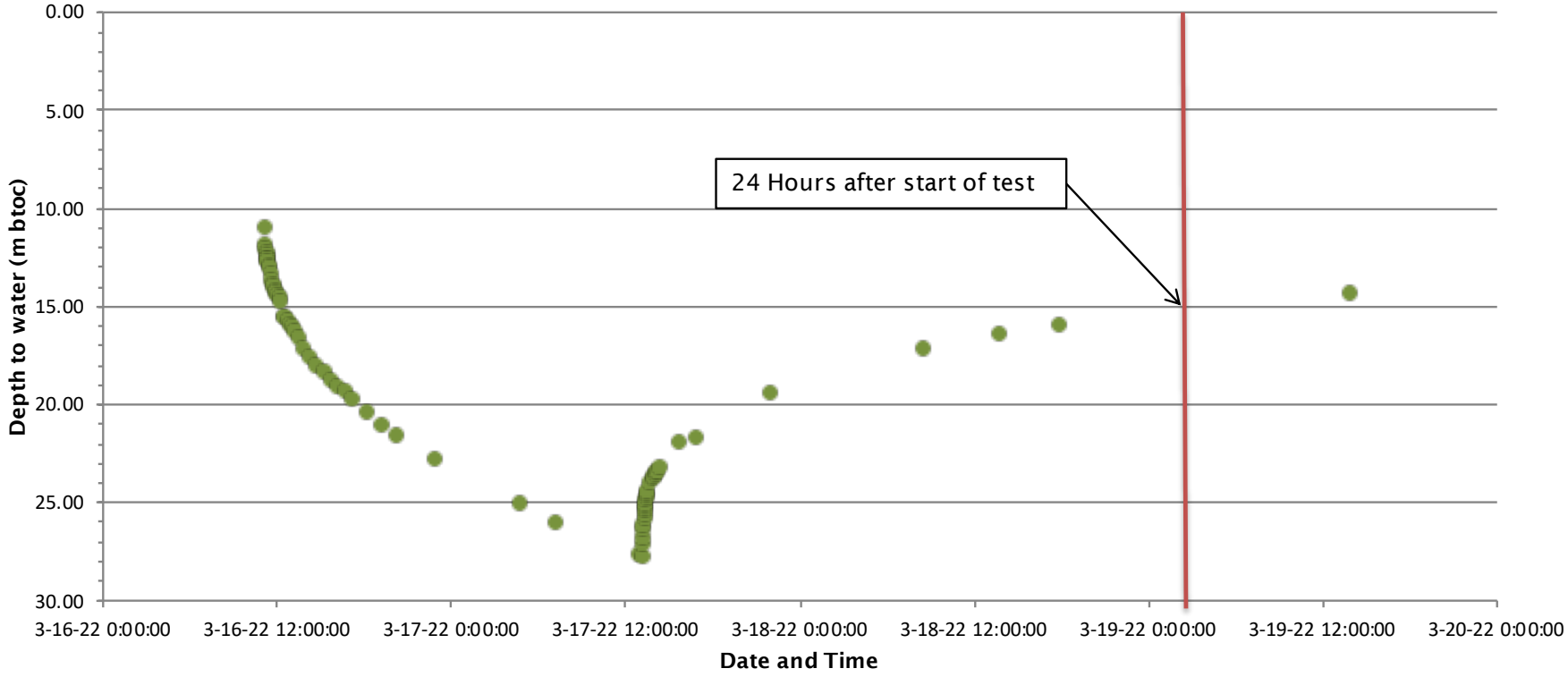
PROJECT:	2022-006		WPID	66090
Client	Viktor Malyakin		Location	Vernon BC
DATE:	06-Apr-22		Date of Test	16-Mar-22
DRAWN BY:	Tony Friesen		Contractor	IGI

Plot of 24-Hour Constant Rate Pumping Data for WPID 66090



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PROJECT:	2022-006		WPID	66090
Client	Viktor Malyakin		Location	7500 McLennan
DATE:	06-Apr-22		Date of Test	16-Mar-22
DRAWN BY:	Tony Friesen		Contractor	IGI

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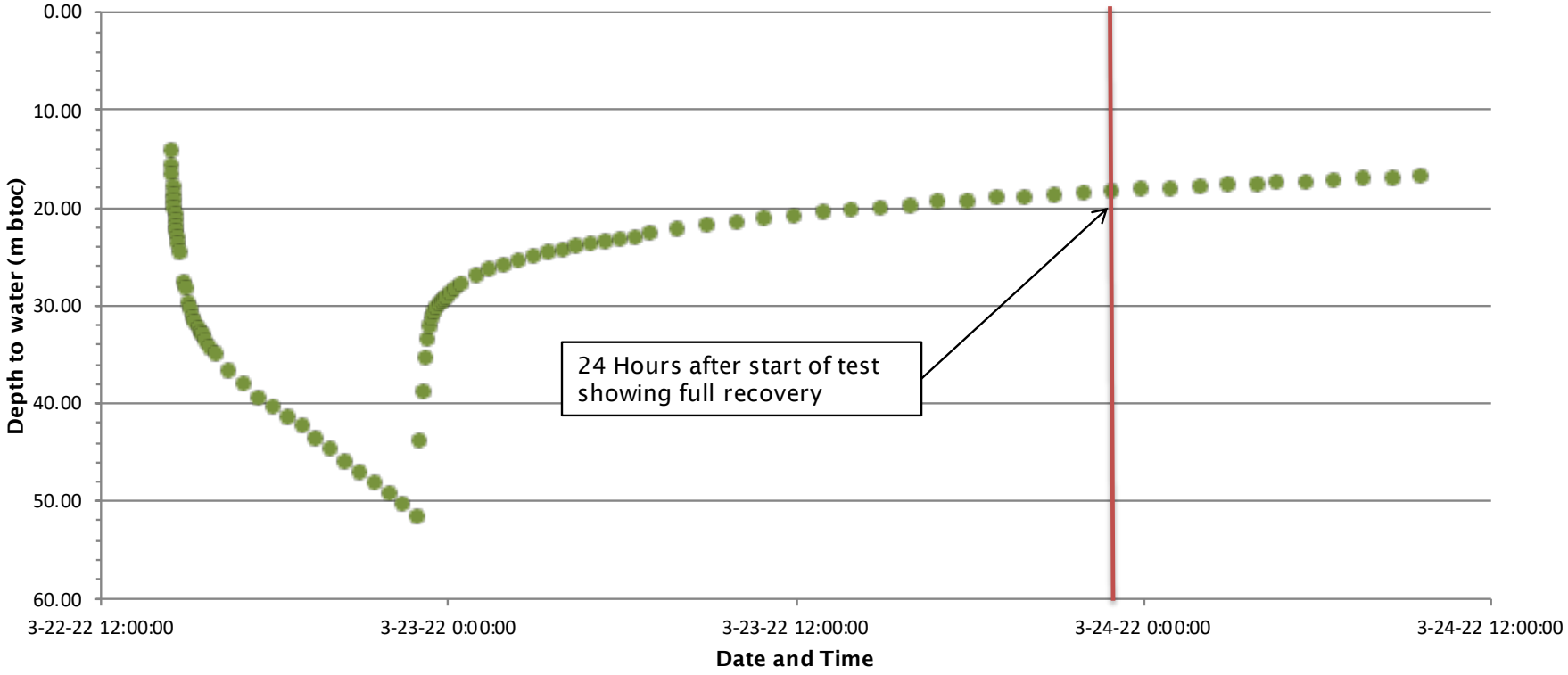
Attachment F
8.5. - Hour Constant Rate Pumping Test Data and Data Plots

Project Number	2022-006		Test Type	Constant Rate Test
Client Name	Viktor Malyakin		Test Duration (hours)	5.5
Hydrogeologist	Tony Friesen		Well Depth (m)	152
Pumping Test Contractor	Moores Well and Pump		Static Water Level (mbtoc)	14.33
Location	7500 McLennan Rd		Pump Intake Depth (mbtoc)	146.00
Well Identification	WPID 66090		Pumping Rate (L/s)	0.47
			Test Start Time	3-22-22 2:30 PM
Clock Time	Time Elapsed (min)	Depth to Water (m btoc)	Drawdown (m)	Comments
3-22-22 14:30:00	0	14.33	0.00	Start of Test
3-22-22 14:31:00	1	15.91	1.58	
3-22-22 14:32:00	2	16.82	2.49	
3-22-22 14:33:00	3	17.96	3.63	
3-22-22 14:34:00	4	18.95	4.62	
3-22-22 14:35:00	5	19.50	5.17	
3-22-22 14:36:00	6	20.17	5.84	
3-22-22 14:37:00	7	20.85	6.52	
3-22-22 14:38:00	8	21.46	7.13	
3-22-22 14:39:00	9	22.07	7.74	
3-22-22 14:40:00	10	22.52	8.19	
3-22-22 14:42:00	12	23.19	8.86	
3-22-22 14:45:00	15	23.90	9.57	
3-22-22 14:47:00	17	24.67	10.34	
3-22-22 14:48:00	18		-14.33	
3-22-22 14:50:00	20		-14.33	
3-22-22 14:55:00	25	27.75	13.42	
3-22-22 15:00:00	30	28.30	13.97	
3-22-22 15:05:00	35	29.86	15.53	
3-22-22 15:10:00	40	30.67	16.34	
3-22-22 15:15:00	45	31.36	17.03	
3-22-22 15:20:00	50	31.91	17.58	
3-22-22 15:25:00	55	32.45	18.12	
3-22-22 15:30:00	60	32.95	18.62	
3-22-22 15:35:00	65	33.27	18.94	
3-22-22 15:40:00	70	33.75	19.42	
3-22-22 15:50:00	80	34.50	20.17	
3-22-22 16:00:00	90	35.02	20.69	
3-22-22 16:30:00	120	36.77	22.44	
3-22-22 17:00:00	150	38.07	23.74	
3-22-22 17:30:00	180	39.56	25.23	
3-22-22 18:00:00	210	40.53	26.20	
3-22-22 18:30:00	240	41.52	27.19	
3-22-22 19:00:00	270	42.50	28.17	
3-22-22 19:30:00	300	43.70	29.37	
3-22-22 20:00:00	330	44.77	30.44	
3-22-22 20:30:00	360	46.18	31.85	
3-22-22 21:00:00	390	47.31	32.98	
3-22-22 21:30:00	420	48.38	34.05	
3-22-22 22:00:00	450	49.42	35.09	
3-22-22 22:30:00	480	50.39	36.06	
3-22-22 23:00:00	510	51.80	37.47	Pump Shut off
3-22-22 23:05:00	515	43.98	29.65	
3-22-22 23:10:00	520	38.97	24.64	
3-22-22 23:15:00	525	35.63	21.30	
3-22-22 23:20:00	530	33.59	19.26	
3-22-22 23:25:00	535	32.32	17.99	
3-22-22 23:30:00	540	31.48	17.15	
3-22-22 23:35:00	545	30.86	16.53	
3-22-22 23:40:00	550	30.39	16.06	
3-22-22 23:45:00	555	30.03	15.70	
3-22-22 23:50:00	560	29.71	15.38	
3-22-22 23:55:00	565	29.44	15.11	
3-23-22 0:00:00	570	29.19	14.86	
3-23-22 0:10:00	580	28.75	14.42	
3-23-22 0:20:00	590	28.38	14.05	
3-23-22 0:30:00	600	28.04	13.71	
3-23-22 1:00:00	630	27.21	12.88	
3-23-22 1:30:00	660	26.56	12.23	
3-23-22 2:00:00	690	26.01	11.68	
3-23-22 2:30:00	720	25.54	11.21	
3-23-22 3:00:00	750	25.12	10.79	
3-23-22 3:30:00	780	24.74	10.41	
3-23-22 4:00:00	810	24.41	10.08	
3-23-22 4:30:00	840	24.08	9.75	
3-23-22 5:00:00	870	23.79	9.46	
3-23-22 5:30:00	900	23.56	9.23	
3-23-22 6:00:00	930	23.34	9.01	
3-23-22 6:30:00	960	23.14	8.81	
3-23-22 7:00:00	990	22.85	8.52	
3-23-22 8:00:00	1050	22.40	8.07	
3-23-22 9:00:00	1110	21.98	7.65	
3-23-22 10:00:00	1170	21.61	7.28	
3-23-22 11:00:00	1230	21.27	6.94	
3-23-22 12:00:00	1290	20.96	6.63	
3-23-22 13:00:00	1350	20.65	6.32	
3-23-22 14:00:00	1410	20.38	6.05	
3-23-22 15:00:00	1470	20.13	5.80	
3-23-22 16:00:00	1530	19.88	5.55	
3-23-22 17:00:00	1590	19.64	5.31	
3-23-22 18:00:00	1650	19.44	5.11	
3-23-22 19:00:00	1710	19.20	4.87	
3-23-22 20:00:00	1770	19.00	4.67	
3-23-22 21:00:00	1830	18.79	4.46	
3-23-22 22:00:00	1890	18.62	4.29	
3-23-22 23:00:00	1950	18.45	4.12	Around 24 hours after shut off
3-24-22 0:00:00	2010	18.29	3.96	
3-24-22 1:00:00	2070	18.15	3.82	
3-24-22 2:00:00	2130	18.01	3.68	
3-24-22 3:00:00	2190	17.86	3.53	
3-24-22 4:00:00	2250	17.73	3.40	
3-24-22 4:40:00	2290	17.64	3.31	
3-24-22 5:40:00	2350	17.49	3.16	
3-24-22 6:40:00	2410	17.37	3.04	
3-24-22 7:40:00	2470	17.25	2.92	
3-24-22 8:40:00	2530	17.13	2.80	
3-24-22 9:40:00	2590	17.02	2.69	

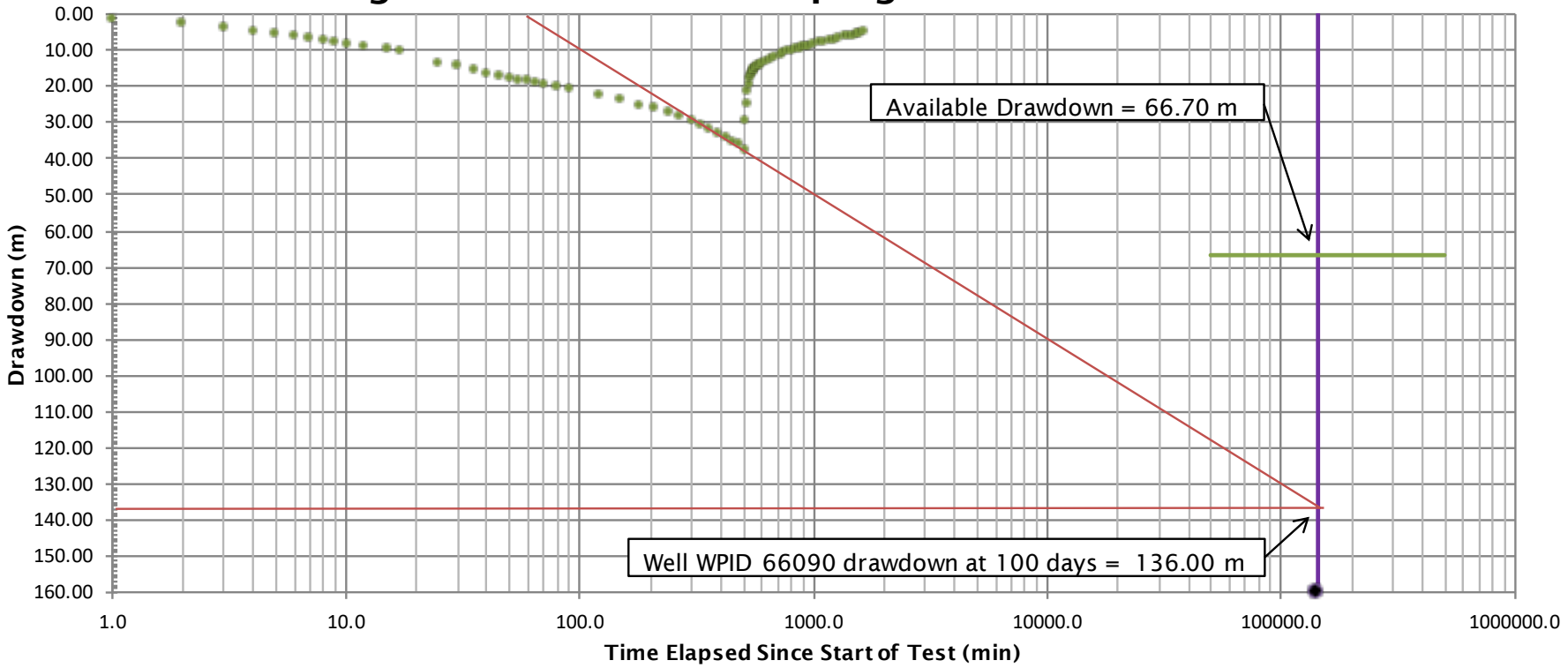
Plot of 8.5 Hour Constant Rate Pumping Data for WPID 66090



Interior Geoscience Inc
Anthony Friesen M.Sc., P.Geo
250-306-4477
tony@interiorgeoscience.com

PROJECT:	2022-006		WPID	66090
Client	Viktor Malyakin		Location	7500 McLennan
DATE:	06-Apr-22		Date of Test	16-Mar-22
DRAWN BY:	Tony Friesen		Contractor	IGI

Semi Log Plot of 8.5 Hour Pumping Test Data for WPIN 66090



Interior Geoscience Inc
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PROJECT:	2022-006		WPID	66090
Client	Viktor Malyakin		Location	Vernon BC
DATE:	06-Apr-22		Date of Test	16-Mar-22
DRAWN BY:	Tony Friesen		Contractor	IGI

Interior Geoscience Inc
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Attachment G
Lab Report

CERTIFICATE OF ANALYSIS

REPORTED TO	Interior Geoscience Inc. 8544 Greenaway Rd. Vernon, BC V1B 3M6		
ATTENTION	Tony Friesen	**WORK ORDER**	22C2535
PO NUMBER		**RECEIVED / TEMP**	2022-03-18 09:06 / 1.8°C
PROJECT	General Potability	**REPORTED**	2022-04-04 10:09
PROJECT INFO		**COC NUMBER**	No Number

Introduction:

CARO Analytical Services is a testing laboratory full of smart, engaged scientists driven to make the world a safer and healthier place. Through our clients' projects we become an essential element for a better world. We employ methods conducted in accordance with recognized professional standards using accepted testing methodologies and quality control efforts. CARO is accredited by the Canadian Association for Laboratories Accreditation (CALA) to ISO/IEC 17025:2017 for specific tests listed in the scope of accreditation approved by CALA.

Big Picture Sidekicks

You know that the sample you collected after snowshoeing to site, digging 5 meters, and racing to get it on a plane so you can submit it to the lab for time sensitive results needed to make important and expensive decisions (whew) is VERY important. We know that too.

We've Got Chemistry

It's simple. We figure the more you enjoy working with our fun and engaged team members; the more likely you are to give us continued opportunities to support you.

Ahead of the Curve

Through research, regulation knowledge, and instrumentation, we are your analytical centre for the technical knowledge you need, BEFORE you need it, so you can stay up to date and in the know.

If you have any questions or concerns, please contact me at teamcaro@caro.ca

Authorized By:

Team CARO
Client Service Representative

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Interior Geoscience Inc.	**WORK ORDER**	22C2535
PROJECT	General Potability	**REPORTED**	2022-04-04 10:09

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
WPID 66090 (22C2535-01) | Matrix: Water | Sampled: 2022-03-17 13:00						
Anions						
Chloride	**11.4**	AO ≤ 250	0.10	mg/L	2022-03-20	
Fluoride	**1.50**	MAC = 1.5	0.10	mg/L	2022-03-20	
Nitrate (as N)	**0.015**	MAC = 10	0.010	mg/L	2022-03-20	
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	2022-03-20	
Sulfate	**235**	AO ≤ 500	1.0	mg/L	2022-03-20	
Calculated Parameters						
Hardness, Total (as CaCO3)	**399**	None Required	0.500	mg/L	N/A	
Langelier Index	< -5.0	N/A	-5.0		2022-03-25	
Solids, Total Dissolved	**610**	AO ≤ 500	10.0	mg/L	N/A	
General Parameters						
Alkalinity, Total (as CaCO3)	**290**	N/A	1.0	mg/L	2022-03-22	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	N/A	1.0	mg/L	2022-03-22	
Alkalinity, Bicarbonate (as CaCO3)	**290**	N/A	1.0	mg/L	2022-03-22	
Alkalinity, Carbonate (as CaCO3)	< 1.0	N/A	1.0	mg/L	2022-03-22	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	N/A	1.0	mg/L	2022-03-22	
Colour, True	**5.4**	AO ≤ 15	5.0	CU	2022-03-21	HT1
Conductivity (EC)	**949**	N/A	2.0	µS/cm	2022-03-22	
Cyanide, Total	< 0.0020	MAC = 0.2	0.0020	mg/L	2022-03-24	
pH	**8.08**	7.0-10.5	0.10	pH units	2022-03-22	HT2
Temperature, at pH	**22.4**	N/A		°C	2022-03-22	HT2
Turbidity	**12.4**	OG < 1	0.10	NTU	2022-03-21	HT1
Microbiological Parameters						
Coliforms, Total	< 1	MAC = 0	1	CFU/100 mL	2022-03-18	
E. coli	< 1	MAC = 0	1	CFU/100 mL	2022-03-18	
Total Metals						
Aluminum, total	**0.0499**	OG < 0.1	0.0050	mg/L	2022-03-23	
Antimony, total	< 0.00020	MAC = 0.006	0.00020	mg/L	2022-03-23	
Arsenic, total	< 0.00050	MAC = 0.01	0.00050	mg/L	2022-03-23	
Barium, total	**0.0260**	MAC = 2	0.0050	mg/L	2022-03-23	
Boron, total	< 0.0500	MAC = 5	0.0500	mg/L	2022-03-23	
Cadmium, total	**0.000015**	MAC = 0.005	0.000010	mg/L	2022-03-23	
Calcium, total	**64.5**	None Required	0.20	mg/L	2022-03-23	
Chromium, total	**0.00111**	MAC = 0.05	0.00050	mg/L	2022-03-23	
Cobalt, total	**0.00043**	N/A	0.00010	mg/L	2022-03-23	
Copper, total	**0.00534**	MAC = 2	0.00040	mg/L	2022-03-23	
Iron, total	**0.293**	AO ≤ 0.3	0.010	mg/L	2022-03-23	
Lead, total	**0.00029**	MAC = 0.005	0.00020	mg/L	2022-03-23	
Magnesium, total	**57.8**	None Required	0.010	mg/L	2022-03-23	
Manganese, total	**0.0279**	MAC = 0.12	0.00020	mg/L	2022-03-23	
Mercury, total	< 0.000010	MAC = 0.001	0.000010	mg/L	2022-03-24	

TEST RESULTS

REPORTED TO	Interior Geoscience Inc.	**WORK ORDER**	22C2535
PROJECT	General Potability	**REPORTED**	2022-04-04 10:09

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
WPID 66090 (22C2535-01) | Matrix: Water | Sampled: 2022-03-17 13:00, Continued						
Total Metals, Continued						
Molybdenum, total	**0.00276**	N/A	0.00010	mg/L	2022-03-23	
Nickel, total	**0.00238**	N/A	0.00040	mg/L	2022-03-23	
Potassium, total	**8.05**	N/A	0.10	mg/L	2022-03-23	
Selenium, total	< 0.00050	MAC = 0.05	0.00050	mg/L	2022-03-23	
Sodium, total	**56.6**	AO ≤ 200	0.10	mg/L	2022-03-23	
Strontium, total	**2.65**	MAC = 7	0.0010	mg/L	2022-03-23	
Uranium, total	**0.000446**	MAC = 0.02	0.000020	mg/L	2022-03-23	
Zinc, total	**0.0336**	AO ≤ 5	0.0040	mg/L	2022-03-23	

Sample Qualifiers:

HT1 The sample was prepared and/or analyzed past the recommended holding time.

HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.

APPENDIX 1: SUPPORTING INFORMATION

REPORTED TO	Interior Geoscience Inc.	**WORK ORDER**	22C2535
PROJECT	General Potability	**REPORTED**	2022-04-04 10:09

Analysis Description	Method Ref.	Technique	Accredited	Location
Alkalinity in Water	SM 2320 B* (2017)	Titration with H2SO4	✓	Kelowna
Anions in Water	SM 4110 B (2017)	Ion Chromatography	✓	Kelowna
Coliforms, Total in Water	SM 9222* (2017)	Membrane Filtration / Chromocult Agar	✓	Kelowna
Colour, True in Water	SM 2120 C (2017)	Spectrophotometry (456 nm)	✓	Kelowna
Conductivity in Water	SM 2510 B (2017)	Conductivity Meter	✓	Kelowna
Cyanide, SAD in Water	ASTM D7511-12	Flow Injection with In-Line UV Digestion and Amperometry	✓	Kelowna
E. coli in Water	SM 9222* (2017)	Membrane Filtration / Chromocult Agar	✓	Kelowna
Hardness in Water	SM 2340 B* (2017)	Calculation: 2.497 [total Ca] + 4.118 [total Mg] (Est)	✓	N/A
Langelier Index in Water	SM 2330 B (2017)	Calculation		N/A
Mercury, total in Water	EPA 245.7*	BrCl2 Oxidation / Cold Vapor Atomic Fluorescence Spectrometry (CVAFS)	✓	Richmond
pH in Water	SM 4500-H+ B (2017)	Electrometry	✓	Kelowna
Solids, Total Dissolved in Water	SM 1030 E (2017)	SM 1030 E (2011)		N/A
Total Metals in Water	EPA 200.2 / EPA 6020B	HNO3+HCl Hot Block Digestion / Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS)	✓	Richmond
Turbidity in Water	SM 2130 B (2017)	Nephelometry	✓	Kelowna

Note: An asterisk in the Method Reference indicates that the CARO method has been modified from the reference method

Glossary of Terms:

RL	Reporting Limit (default)
<	Less than the specified Reporting Limit (RL) - the actual RL may be higher than the default RL due to various factors
°C	Degrees Celcius
AO	Aesthetic Objective
CFU/100 mL	Colony Forming Units per 100 millilitres
CU	Colour Units (referenced against a platinum cobalt standard)
MAC	Maximum Acceptable Concentration (health based)
mg/L	Milligrams per litre
NTU	Nephelometric Turbidity Units
OG	Operational Guideline (treated water)
pH units	pH < 7 = acidic, ph > 7 = basic
µS/cm	Microsiemens per centimetre
ASTM	ASTM International Test Methods
EPA	United States Environmental Protection Agency Test Methods
SM	Standard Methods for the Examination of Water and Wastewater, American Public Health Association

APPENDIX 1: SUPPORTING INFORMATION

REPORTED TO	Interior Geoscience Inc.	**WORK ORDER**	22C2535
PROJECT	General Potability	**REPORTED**	2022-04-04 10:09

General Comments:

The results in this report apply to the samples analyzed in accordance with the Chain of Custody document. This analytical report must be reproduced in its entirety. CARO is not responsible for any loss or damage resulting directly or indirectly from error or omission in the conduct of testing. Liability is limited to the cost of analysis. Samples will be disposed of 30 days after the test report has been issued or once samples expire, whichever comes first. Longer hold is possible if agreed to in writing.

Results in **Bold** indicate values that are above CARO's method reporting limits. Any results that are above regulatory limits are highlighted **red**. Please note that results will only be highlighted red if the regulatory limits are included on the CARO report. Any Bold and/or highlighted results do not take into account method uncertainty. If you would like method uncertainty or regulatory limits to be included on your report, please contact your Account Manager:teamcaro@caro.ca

Please note any regulatory guidelines applied to this report are added as a convenience to the client, at their request, to help provide some initial context to analytical results obtained. Although CARO makes every effort to ensure accuracy of the associated regulatory guideline(s) applied, the guidelines applied cannot be assumed to be correct due to a variety of factors and as such CARO Analytical Services assumes no liability or responsibility for the use of those guidelines to make any decisions. The original source of the regulation should be verified and a review of the guideline (s) should be validated as correct in order to make any decisions arising from the comparison of the analytical data obtained to the relevant regulatory guideline for one's particular circumstances. Further, CARO Analytical Services assumes no liability or responsibility for any loss attributed from the use of these guidelines in any way.

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Interior Geoscience Inc.	**WORK ORDER**	22C2535
PROJECT	General Potability	**REPORTED**	2022-04-04 10:09

The following section displays the quality control (QC) data that is associated with your sample data. Groups of samples are prepared in "batches" and analyzed in conjunction with QC samples that ensure your data is of the highest quality. Common QC types include:

- **Method Blank (Blk)**: A blank sample that undergoes sample processing identical to that carried out for the test samples. Method blank results are used to assess contamination from the laboratory environment and reagents.
- **Duplicate (Dup)**: An additional or second portion of a randomly selected sample in the analytical run carried through the entire analytical process. Duplicates provide a measure of the analytical method's precision (reproducibility).
- **Blank Spike (BS)**: A sample of known concentration which undergoes processing identical to that carried out for test samples, also referred to as a laboratory control sample (LCS). Blank spikes provide a measure of the analytical method's accuracy.
- **Matrix Spike (MS)**: A second aliquot of sample is fortified with a known concentration of target analytes and carried through the entire analytical process. Matrix spikes evaluate potential matrix effects that may affect the analyte recovery.
- **Reference Material (SRM)**: A homogenous material of similar matrix to the samples, certified for the parameter(s) listed. Reference Materials ensure that the analytical process is adequate to achieve acceptable recoveries of the parameter(s) tested.

Each QC type is analyzed at a 5-10% frequency, i.e. one blank/duplicate/spike for every 10-20 samples. For all types of QC, the specified recovery (% Rec) and relative percent difference (RPD) limits are derived from long-term method performance averages and/or prescribed by the reference method.

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Anions, Batch B2C2122										
Blank (B2C2122-BLK1)				Prepared: 2022-03-19, Analyzed: 2022-03-19						
Chloride	< 0.10	0.10	mg/L							
Fluoride	< 0.10	0.10	mg/L							
Nitrate (as N)	< 0.010	0.010	mg/L							
Nitrite (as N)	< 0.010	0.010	mg/L							
Sulfate	< 1.0	1.0	mg/L							
Blank (B2C2122-BLK2)				Prepared: 2022-03-20, Analyzed: 2022-03-20						
Chloride	< 0.10	0.10	mg/L							
Fluoride	< 0.10	0.10	mg/L							
Nitrate (as N)	< 0.010	0.010	mg/L							
Nitrite (as N)	< 0.010	0.010	mg/L							
Sulfate	< 1.0	1.0	mg/L							
LCS (B2C2122-BS1)				Prepared: 2022-03-19, Analyzed: 2022-03-19						
Chloride	15.7	0.10	mg/L	16.0		98	90-110			
Fluoride	4.02	0.10	mg/L	4.00		100	88-108			
Nitrate (as N)	3.86	0.010	mg/L	4.00		97	90-110			
Nitrite (as N)	2.06	0.010	mg/L	2.00		103	85-115			
Sulfate	15.9	1.0	mg/L	16.0		99	90-110			
LCS (B2C2122-BS2)				Prepared: 2022-03-20, Analyzed: 2022-03-20						
Chloride	15.8	0.10	mg/L	16.0		99	90-110			
Fluoride	4.01	0.10	mg/L	4.00		100	88-108			
Nitrate (as N)	3.87	0.010	mg/L	4.00		97	90-110			
Nitrite (as N)	2.02	0.010	mg/L	2.00		101	85-115			
Sulfate	15.9	1.0	mg/L	16.0		100	90-110			
General Parameters, Batch B2C2174										
Blank (B2C2174-BLK1)				Prepared: 2022-03-21, Analyzed: 2022-03-21						
Colour, True	< 5.0	5.0	CU							
Blank (B2C2174-BLK2)				Prepared: 2022-03-21, Analyzed: 2022-03-21						
Colour, True	< 5.0	5.0	CU							

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Interior Geoscience Inc.	**WORK ORDER**	22C2535
PROJECT	General Potability	**REPORTED**	2022-04-04 10:09

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
General Parameters, Batch B2C2174, Continued										
LCS (B2C2174-BS1)				Prepared: 2022-03-21, Analyzed: 2022-03-21						
Colour, True	21	5.0	CU	20.0		107	85-115			
LCS (B2C2174-BS2)				Prepared: 2022-03-21, Analyzed: 2022-03-21						
Colour, True	22	5.0	CU	20.0		111	85-115			
General Parameters, Batch B2C2262										
Blank (B2C2262-BLK1)				Prepared: 2022-03-21, Analyzed: 2022-03-21						
Turbidity	< 0.10	0.10	NTU							
Blank (B2C2262-BLK2)				Prepared: 2022-03-21, Analyzed: 2022-03-21						
Turbidity	< 0.10	0.10	NTU							
LCS (B2C2262-BS1)				Prepared: 2022-03-21, Analyzed: 2022-03-21						
Turbidity	38.6	0.10	NTU	40.0		96	90-110			
LCS (B2C2262-BS2)				Prepared: 2022-03-21, Analyzed: 2022-03-21						
Turbidity	39.7	0.10	NTU	40.0		99	90-110			
General Parameters, Batch B2C2385										
Blank (B2C2385-BLK1)				Prepared: 2022-03-22, Analyzed: 2022-03-22						
Alkalinity, Total (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Bicarbonate (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Carbonate (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Hydroxide (as CaCO3)	< 1.0	1.0	mg/L							
Conductivity (EC)	< 2.0	2.0	µS/cm							
Temperature, at pH	23.2		°C							
Blank (B2C2385-BLK2)				Prepared: 2022-03-22, Analyzed: 2022-03-22						
Alkalinity, Total (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Bicarbonate (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Carbonate (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Hydroxide (as CaCO3)	< 1.0	1.0	mg/L							
Conductivity (EC)	< 2.0	2.0	µS/cm							
Temperature, at pH	24.3		°C							
LCS (B2C2385-BS1)				Prepared: 2022-03-22, Analyzed: 2022-03-22						
Alkalinity, Total (as CaCO3)	107	1.0	mg/L	100		107	80-120			
LCS (B2C2385-BS2)				Prepared: 2022-03-22, Analyzed: 2022-03-22						
Alkalinity, Total (as CaCO3)	107	1.0	mg/L	100		107	80-120			
LCS (B2C2385-BS3)				Prepared: 2022-03-22, Analyzed: 2022-03-22						
Conductivity (EC)	1440	2.0	µS/cm	1410		102	95-105			
LCS (B2C2385-BS4)				Prepared: 2022-03-22, Analyzed: 2022-03-22						
Conductivity (EC)	1460	2.0	µS/cm	1410		103	95-105			
Reference (B2C2385-SRM1)				Prepared: 2022-03-22, Analyzed: 2022-03-22						
pH	7.00	0.10	pH units	7.01		100	98-102			
Reference (B2C2385-SRM2)				Prepared: 2022-03-22, Analyzed: 2022-03-22						
pH	7.00	0.10	pH units	7.01		100	98-102			

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Interior Geoscience Inc.	**WORK ORDER**	22C2535
PROJECT	General Potability	**REPORTED**	2022-04-04 10:09

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
General Parameters, Batch B2C2676										
Blank (B2C2676-BLK1)				Prepared: 2022-03-24, Analyzed: 2022-03-24						
Cyanide, Total	< 0.0020	0.0020	mg/L							
Blank (B2C2676-BLK2)				Prepared: 2022-03-24, Analyzed: 2022-03-24						
Cyanide, Total	< 0.0020	0.0020	mg/L							
LCS (B2C2676-BS1)				Prepared: 2022-03-24, Analyzed: 2022-03-24						
Cyanide, Total	0.0191	0.0020	mg/L	0.0200		96	82-120			
LCS (B2C2676-BS2)				Prepared: 2022-03-24, Analyzed: 2022-03-24						
Cyanide, Total	0.0191	0.0020	mg/L	0.0200		96	82-120			
LCS Dup (B2C2676-BSD1)				Prepared: 2022-03-24, Analyzed: 2022-03-24						
Cyanide, Total	0.0193	0.0020	mg/L	0.0200		97	82-120	1	10	
LCS Dup (B2C2676-BSD2)				Prepared: 2022-03-24, Analyzed: 2022-03-24						
Cyanide, Total	0.0200	0.0020	mg/L	0.0200		100	82-120	5	10	
Microbiological Parameters, Batch B2C2077										
Blank (B2C2077-BLK1)				Prepared: 2022-03-18, Analyzed: 2022-03-18						
Coliforms, Total	< 1	1	CFU/100 mL							
E. coli	< 1	1	CFU/100 mL							
Blank (B2C2077-BLK2)				Prepared: 2022-03-18, Analyzed: 2022-03-18						
Coliforms, Total	< 1	1	CFU/100 mL							
E. coli	< 1	1	CFU/100 mL							
Blank (B2C2077-BLK3)				Prepared: 2022-03-18, Analyzed: 2022-03-18						
Coliforms, Total	< 1	1	CFU/100 mL							
E. coli	< 1	1	CFU/100 mL							
Blank (B2C2077-BLK4)				Prepared: 2022-03-18, Analyzed: 2022-03-18						
Coliforms, Total	< 1	1	CFU/100 mL							
E. coli	< 1	1	CFU/100 mL							
Blank (B2C2077-BLK5)				Prepared: 2022-03-18, Analyzed: 2022-03-18						
Coliforms, Total	< 1	1	CFU/100 mL							
E. coli	< 1	1	CFU/100 mL							
Total Metals, Batch B2C2428										
Blank (B2C2428-BLK1)				Prepared: 2022-03-23, Analyzed: 2022-03-23						
Aluminum, total	< 0.0050	0.0050	mg/L							
Antimony, total	< 0.00020	0.00020	mg/L							
Arsenic, total	< 0.00050	0.00050	mg/L							
Barium, total	< 0.0050	0.0050	mg/L							
Boron, total	< 0.0500	0.0500	mg/L							
Cadmium, total	< 0.000010	0.000010	mg/L							
Calcium, total	< 0.20	0.20	mg/L							
Chromium, total	< 0.00050	0.00050	mg/L							
Cobalt, total	< 0.00010	0.00010	mg/L							
Copper, total	< 0.00040	0.00040	mg/L							
Iron, total	< 0.010	0.010	mg/L							
Lead, total	< 0.00020	0.00020	mg/L							
Magnesium, total	< 0.010	0.010	mg/L							
Manganese, total	< 0.00020	0.00020	mg/L							

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Interior Geoscience Inc.	**WORK ORDER**	22C2535
PROJECT	General Potability	**REPORTED**	2022-04-04 10:09

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Total Metals, Batch B2C2428, Continued										
Blank (B2C2428-BLK1), Continued				Prepared: 2022-03-23, Analyzed: 2022-03-23						
Molybdenum, total	< 0.00010	0.00010	mg/L							
Nickel, total	< 0.00040	0.00040	mg/L							
Potassium, total	< 0.10	0.10	mg/L							
Selenium, total	< 0.00050	0.00050	mg/L							
Sodium, total	< 0.10	0.10	mg/L							
Strontium, total	< 0.0010	0.0010	mg/L							
Uranium, total	< 0.000020	0.000020	mg/L							
Zinc, total	< 0.0040	0.0040	mg/L							
LCS (B2C2428-BS1)				Prepared: 2022-03-23, Analyzed: 2022-03-23						
Aluminum, total	0.0161	0.0050	mg/L	0.0200		81	80-120			
Antimony, total	0.0191	0.00020	mg/L	0.0200		95	80-120			
Arsenic, total	0.0190	0.00050	mg/L	0.0200		95	80-120			
Barium, total	0.0172	0.0050	mg/L	0.0200		86	80-120			
Boron, total	< 0.0500	0.0500	mg/L	0.0200		97	80-120			
Cadmium, total	0.0192	0.000010	mg/L	0.0200		96	80-120			
Calcium, total	1.78	0.20	mg/L	2.00		89	80-120			
Chromium, total	0.0187	0.00050	mg/L	0.0200		94	80-120			
Cobalt, total	0.0188	0.00010	mg/L	0.0200		94	80-120			
Copper, total	0.0213	0.00040	mg/L	0.0200		107	80-120			
Iron, total	2.02	0.010	mg/L	2.00		101	80-120			
Lead, total	0.0200	0.00020	mg/L	0.0200		100	80-120			
Magnesium, total	1.88	0.010	mg/L	2.00		94	80-120			
Manganese, total	0.0184	0.00020	mg/L	0.0200		92	80-120			
Molybdenum, total	0.0206	0.00010	mg/L	0.0200		103	80-120			
Nickel, total	0.0197	0.00040	mg/L	0.0200		99	80-120			
Potassium, total	1.95	0.10	mg/L	2.00		98	80-120			
Selenium, total	0.0194	0.00050	mg/L	0.0200		97	80-120			
Sodium, total	2.01	0.10	mg/L	2.00		100	80-120			
Strontium, total	0.0173	0.0010	mg/L	0.0200		87	80-120			
Uranium, total	0.0189	0.000020	mg/L	0.0200		95	80-120			
Zinc, total	0.0188	0.0040	mg/L	0.0200		94	80-120			
Reference (B2C2428-SRM1)				Prepared: 2022-03-23, Analyzed: 2022-03-23						
Aluminum, total	0.194	0.0050	mg/L	0.198		98	70-130			
Antimony, total	0.0243	0.00020	mg/L	0.0230		106	70-130			
Arsenic, total	0.0214	0.00050	mg/L	0.0200		107	70-130			
Barium, total	0.0147	0.0050	mg/L	0.0161		91	70-130			
Boron, total	0.184	0.0500	mg/L	0.191		97	70-130			
Cadmium, total	0.00412	0.000010	mg/L	0.00404		102	70-130			
Calcium, total	0.94	0.20	mg/L	0.938		100	70-130			
Chromium, total	0.0251	0.00050	mg/L	0.0256		98	70-130			
Cobalt, total	0.0222	0.00010	mg/L	0.0214		104	70-130			
Copper, total	0.0330	0.00040	mg/L	0.0322		102	70-130			
Iron, total	0.064	0.010	mg/L	0.0580		111	70-130			
Lead, total	0.00878	0.00020	mg/L	0.00796		110	70-130			
Magnesium, total	0.108	0.010	mg/L	0.112		97	70-130			
Manganese, total	0.0117	0.00020	mg/L	0.0120		97	70-130			
Molybdenum, total	0.0451	0.00010	mg/L	0.0438		103	70-130			
Nickel, total	0.0415	0.00040	mg/L	0.0394		105	70-130			
Potassium, total	0.87	0.10	mg/L	0.820		106	70-130			
Selenium, total	0.123	0.00050	mg/L	0.117		105	70-130			
Sodium, total	0.53	0.10	mg/L	0.490		108	70-130			
Strontium, total	0.258	0.0010	mg/L	0.276		93	70-130			
Uranium, total	0.00995	0.000020	mg/L	0.00970		103	70-130			
Zinc, total	0.0843	0.0040	mg/L	0.0884		95	70-130			

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Interior Geoscience Inc.	**WORK ORDER**	22C2535
PROJECT	General Potability	**REPORTED**	2022-04-04 10:09

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Total Metals, Batch B2C2643										
Blank (B2C2643-BLK1)				Prepared: 2022-03-23, Analyzed: 2022-03-24						
Mercury, total	< 0.000010	0.000010	mg/L							
Blank (B2C2643-BLK2)				Prepared: 2022-03-23, Analyzed: 2022-03-24						
Mercury, total	< 0.000010	0.000010	mg/L							
Blank (B2C2643-BLK3)				Prepared: 2022-03-23, Analyzed: 2022-03-24						
Mercury, total	< 0.000010	0.000010	mg/L							
Reference (B2C2643-SRM1)				Prepared: 2022-03-23, Analyzed: 2022-03-24						
Mercury, total	0.000268	0.000010	mg/L	0.000250		107	0-200			
Reference (B2C2643-SRM2)				Prepared: 2022-03-23, Analyzed: 2022-03-24						
Mercury, total	0.000260	0.000010	mg/L	0.000250		104	0-200			
Reference (B2C2643-SRM3)				Prepared: 2022-03-23, Analyzed: 2022-03-24						
Mercury, total	0.000265	0.000010	mg/L	0.000250		106	0-200			

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Interior Geoscience Inc.	**WORK ORDER**	22C2535
PROJECT	General Potability	**REPORTED**	2022-04-04 10:09

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
General Parameters, Batch B2C2676										
Blank (B2C2676-BLK1)				Prepared: 2022-03-24, Analyzed: 2022-03-24						
Cyanide, Total	< 0.0020	0.0020	mg/L							
Blank (B2C2676-BLK2)				Prepared: 2022-03-24, Analyzed: 2022-03-24						
Cyanide, Total	< 0.0020	0.0020	mg/L							
LCS (B2C2676-BS1)				Prepared: 2022-03-24, Analyzed: 2022-03-24						
Cyanide, Total	0.0191	0.0020	mg/L	0.0200		96	82-120			
LCS (B2C2676-BS2)				Prepared: 2022-03-24, Analyzed: 2022-03-24						
Cyanide, Total	0.0191	0.0020	mg/L	0.0200		96	82-120			
LCS Dup (B2C2676-BSD1)				Prepared: 2022-03-24, Analyzed: 2022-03-24						
Cyanide, Total	0.0193	0.0020	mg/L	0.0200		97	82-120	1	10	
LCS Dup (B2C2676-BSD2)				Prepared: 2022-03-24, Analyzed: 2022-03-24						
Cyanide, Total	0.0200	0.0020	mg/L	0.0200		100	82-120	5	10	
Microbiological Parameters, Batch B2C2077										
Blank (B2C2077-BLK1)				Prepared: 2022-03-18, Analyzed: 2022-03-18						
Coliforms, Total	< 1	1	CFU/100 mL							
E. coli	< 1	1	CFU/100 mL							
Blank (B2C2077-BLK2)				Prepared: 2022-03-18, Analyzed: 2022-03-18						
Coliforms, Total	< 1	1	CFU/100 mL							
E. coli	< 1	1	CFU/100 mL							
Blank (B2C2077-BLK3)				Prepared: 2022-03-18, Analyzed: 2022-03-18						
Coliforms, Total	< 1	1	CFU/100 mL							
E. coli	< 1	1	CFU/100 mL							
Blank (B2C2077-BLK4)				Prepared: 2022-03-18, Analyzed: 2022-03-18						
Coliforms, Total	< 1	1	CFU/100 mL							
E. coli	< 1	1	CFU/100 mL							
Blank (B2C2077-BLK5)				Prepared: 2022-03-18, Analyzed: 2022-03-18						
Coliforms, Total	< 1	1	CFU/100 mL							
E. coli	< 1	1	CFU/100 mL							
Total Metals, Batch B2C2428										
Blank (B2C2428-BLK1)				Prepared: 2022-03-23, Analyzed: 2022-03-23						
Aluminum, total	< 0.0050	0.0050	mg/L							
Antimony, total	< 0.00020	0.00020	mg/L							
Arsenic, total	< 0.00050	0.00050	mg/L							
Barium, total	< 0.0050	0.0050	mg/L							
Boron, total	< 0.0500	0.0500	mg/L							
Cadmium, total	< 0.000010	0.000010	mg/L							
Calcium, total	< 0.20	0.20	mg/L							
Chromium, total	< 0.00050	0.00050	mg/L							
Cobalt, total	< 0.00010	0.00010	mg/L							
Copper, total	< 0.00040	0.00040	mg/L							
Iron, total	< 0.010	0.010	mg/L							
Lead, total	< 0.00020	0.00020	mg/L							
Magnesium, total	< 0.010	0.010	mg/L							
Manganese, total	< 0.00020	0.00020	mg/L							

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Interior Geoscience Inc.	**WORK ORDER**	22C2535
PROJECT	General Potability	**REPORTED**	2022-04-04 10:09

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Total Metals, Batch B2C2428, Continued										
Blank (B2C2428-BLK1), Continued				Prepared: 2022-03-23, Analyzed: 2022-03-23						
Molybdenum, total	< 0.00010	0.00010	mg/L							
Nickel, total	< 0.00040	0.00040	mg/L							
Potassium, total	< 0.10	0.10	mg/L							
Selenium, total	< 0.00050	0.00050	mg/L							
Sodium, total	< 0.10	0.10	mg/L							
Strontium, total	< 0.0010	0.0010	mg/L							
Uranium, total	< 0.000020	0.000020	mg/L							
Zinc, total	< 0.0040	0.0040	mg/L							
LCS (B2C2428-BS1)				Prepared: 2022-03-23, Analyzed: 2022-03-23						
Aluminum, total	0.0161	0.0050	mg/L	0.0200		81	80-120			
Antimony, total	0.0191	0.00020	mg/L	0.0200		95	80-120			
Arsenic, total	0.0190	0.00050	mg/L	0.0200		95	80-120			
Barium, total	0.0172	0.0050	mg/L	0.0200		86	80-120			
Boron, total	< 0.0500	0.0500	mg/L	0.0200		97	80-120			
Cadmium, total	0.0192	0.000010	mg/L	0.0200		96	80-120			
Calcium, total	1.78	0.20	mg/L	2.00		89	80-120			
Chromium, total	0.0187	0.00050	mg/L	0.0200		94	80-120			
Cobalt, total	0.0188	0.00010	mg/L	0.0200		94	80-120			
Copper, total	0.0213	0.00040	mg/L	0.0200		107	80-120			
Iron, total	2.02	0.010	mg/L	2.00		101	80-120			
Lead, total	0.0200	0.00020	mg/L	0.0200		100	80-120			
Magnesium, total	1.88	0.010	mg/L	2.00		94	80-120			
Manganese, total	0.0184	0.00020	mg/L	0.0200		92	80-120			
Molybdenum, total	0.0206	0.00010	mg/L	0.0200		103	80-120			
Nickel, total	0.0197	0.00040	mg/L	0.0200		99	80-120			
Potassium, total	1.95	0.10	mg/L	2.00		98	80-120			
Selenium, total	0.0194	0.00050	mg/L	0.0200		97	80-120			
Sodium, total	2.01	0.10	mg/L	2.00		100	80-120			
Strontium, total	0.0173	0.0010	mg/L	0.0200		87	80-120			
Uranium, total	0.0189	0.000020	mg/L	0.0200		95	80-120			
Zinc, total	0.0188	0.0040	mg/L	0.0200		94	80-120			
Reference (B2C2428-SRM1)				Prepared: 2022-03-23, Analyzed: 2022-03-23						
Aluminum, total	0.194	0.0050	mg/L	0.198		98	70-130			
Antimony, total	0.0243	0.00020	mg/L	0.0230		106	70-130			
Arsenic, total	0.0214	0.00050	mg/L	0.0200		107	70-130			
Barium, total	0.0147	0.0050	mg/L	0.0161		91	70-130			
Boron, total	0.184	0.0500	mg/L	0.191		97	70-130			
Cadmium, total	0.00412	0.000010	mg/L	0.00404		102	70-130			
Calcium, total	0.94	0.20	mg/L	0.938		100	70-130			
Chromium, total	0.0251	0.00050	mg/L	0.0256		98	70-130			
Cobalt, total	0.0222	0.00010	mg/L	0.0214		104	70-130			
Copper, total	0.0330	0.00040	mg/L	0.0322		102	70-130			
Iron, total	0.064	0.010	mg/L	0.0580		111	70-130			
Lead, total	0.00878	0.00020	mg/L	0.00796		110	70-130			
Magnesium, total	0.108	0.010	mg/L	0.112		97	70-130			
Manganese, total	0.0117	0.00020	mg/L	0.0120		97	70-130			
Molybdenum, total	0.0451	0.00010	mg/L	0.0438		103	70-130			
Nickel, total	0.0415	0.00040	mg/L	0.0394		105	70-130			
Potassium, total	0.87	0.10	mg/L	0.820		106	70-130			
Selenium, total	0.123	0.00050	mg/L	0.117		105	70-130			
Sodium, total	0.53	0.10	mg/L	0.490		108	70-130			
Strontium, total	0.258	0.0010	mg/L	0.276		93	70-130			
Uranium, total	0.00995	0.000020	mg/L	0.00970		103	70-130			
Zinc, total	0.0843	0.0040	mg/L	0.0884		95	70-130			

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Interior Geoscience Inc.	**WORK ORDER**	22C2535
PROJECT	General Potability	**REPORTED**	2022-04-04 10:09

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Total Metals, Batch B2C2643										
Blank (B2C2643-BLK1)				Prepared: 2022-03-23, Analyzed: 2022-03-24						
Mercury, total	< 0.000010	0.000010	mg/L							
Blank (B2C2643-BLK2)				Prepared: 2022-03-23, Analyzed: 2022-03-24						
Mercury, total	< 0.000010	0.000010	mg/L							
Blank (B2C2643-BLK3)				Prepared: 2022-03-23, Analyzed: 2022-03-24						
Mercury, total	< 0.000010	0.000010	mg/L							
Reference (B2C2643-SRM1)				Prepared: 2022-03-23, Analyzed: 2022-03-24						
Mercury, total	0.000268	0.000010	mg/L	0.000250		107	0-200			
Reference (B2C2643-SRM2)				Prepared: 2022-03-23, Analyzed: 2022-03-24						
Mercury, total	0.000260	0.000010	mg/L	0.000250		104	0-200			
Reference (B2C2643-SRM3)				Prepared: 2022-03-23, Analyzed: 2022-03-24						
Mercury, total	0.000265	0.000010	mg/L	0.000250		106	0-200			

CERTIFICATE OF ANALYSIS

REPORTED TO Tony Friesen (Interior Geoscience Inc.)
8544 Greenaway Rd.
Vernon, BC V1B 3M6

SITE INFO
CARO WO# 22K0663

RECEIVED / TEMP 2022-11-04 14:30 / 8.9°C
REPORTED 2022-11-09

Introduction:

CARO Analytical Services is a testing laboratory full of smart, engaged scientists driven to make the world a safer and healthier place. Through our clients' projects we become an essential element for a better world. We employ methods conducted in accordance with recognized professional standards using accepted testing methodologies and quality control efforts. CARO is accredited by the Canadian Association for Laboratories Accreditation (CALA) to ISO/IEC 17025:2017 for specific tests listed in the scope of accreditation approved by CALA.

Big Picture Sidekicks

You know that the sample you collected after snowshoeing to site, digging 5 meters, and racing to get it on a plane so you can submit it to the lab for time sensitive results needed to make important and expensive decisions (whew) is VERY important. We know that too.

We've Got Chemistry

It's simple. We figure the more you enjoy working with our fun and engaged team members; the more likely you are to give us continued opportunities to support you.

Ahead of the Curve

Through research, regulation knowledge, and instrumentation, we are your analytical centre for the technical knowledge you need, BEFORE you need it, so you can stay up to date and in the know.

Report Highlights:

The results in this report apply to the samples analyzed in accordance with your submission. The following parameter(s) exceed the Guidelines for Canadian Drinking Water Quality (Jan 2020):

Sample Name: WIPD 47667

1. Iron, total (AO)
2. Solids, Total Dissolved (AO)
3. Turbidity (OG)

For more information, please visit http://www.caro.ca/reports/

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Laboratory Recommendations:

For assistance reading your report, please visit
https://www.caro.ca/wp-content/uploads/2020/07/How-to-read-your-report-1.pdf
For information about bacteria in water results, please visit
https://www.caro.ca/you-need-to-know-about-bacteria-in-water-analytical-report/
If you have any additional questions or concerns, please contact us at TeamCaro@caro.ca.

Authorized By:

Team CARO
Client Service Representative

TEST RESULTS

REPORTED TO Tony Friesen (Interior Geoscience Inc.)
CARO WO# 22K0663 **REPORTED** 2022-11-09

Parameter	Result	Guideline	RL	Units	Analyzed	Note
Sample Name: WIPD 47667 | Matrix: Water | Sampled: 2022-11-03 21:00						
Anions						
Chloride	**12.2**	AO ≤ 250	0.10	mg/L	2022-11-05	
Fluoride	**1.33**	MAC = 1.5	0.10	mg/L	2022-11-05	
Nitrate (as N)	< 0.010	MAC = 10	0.010	mg/L	2022-11-05	
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	2022-11-05	
Sulfate	**237**	AO ≤ 500	1.0	mg/L	2022-11-05	
Calculated Parameters						
Hardness, Total (as CaCO3)	**411**	None Required	0.500	mg/L	N/A	
Solids, Total Dissolved	**619**	AO ≤ 500	10.0	mg/L	N/A	
General Parameters						
Alkalinity, Total (as CaCO3)	**283**	N/A	1.0	mg/L	2022-11-07	
Conductivity (EC)	**974**	N/A	2.0	µS/cm	2022-11-07	
Cyanide, Total	< 0.0020	MAC = 0.2	0.0020	mg/L	2022-11-08	
pH	**8.15**	7.0-10.5	0.10	pH units	2022-11-07	HT2
Turbidity	**2.61**	OG < 1	0.10	NTU	2022-11-06	
Microbiological Parameters						
Coliforms, Total	< 1	MAC = 0	1	CFU/100 mL	2022-11-04	
E. coli	< 1	MAC = 0	1	CFU/100 mL	2022-11-04	
Total Metals						
Aluminum, total	**0.0065**	OG < 0.1	0.0050	mg/L	2022-11-08	
Antimony, total	< 0.00020	MAC = 0.006	0.00020	mg/L	2022-11-08	
Arsenic, total	< 0.00050	MAC = 0.01	0.00050	mg/L	2022-11-08	
Barium, total	**0.0256**	MAC = 2	0.0050	mg/L	2022-11-08	
Boron, total	< 0.0500	MAC = 5	0.0500	mg/L	2022-11-08	
Cadmium, total	< 0.000010	MAC = 0.005	0.000010	mg/L	2022-11-08	
Calcium, total	**74.2**	None Required	0.20	mg/L	2022-11-08	
Chromium, total	**0.00200**	MAC = 0.05	0.00050	mg/L	2022-11-08	
Copper, total	**0.0116**	MAC = 2	0.00040	mg/L	2022-11-08	
Iron, total	**0.469**	AO ≤ 0.3	0.010	mg/L	2022-11-08	
Lead, total	**0.00057**	MAC = 0.005	0.00020	mg/L	2022-11-08	
Magnesium, total	**54.8**	None Required	0.010	mg/L	2022-11-08	
Manganese, total	**0.0482**	MAC = 0.12	0.00020	mg/L	2022-11-08	
Potassium, total	**9.41**	N/A	0.10	mg/L	2022-11-08	
Selenium, total	< 0.00050	MAC = 0.05	0.00050	mg/L	2022-11-08	
Sodium, total	**59.4**	AO ≤ 200	0.10	mg/L	2022-11-08	
Strontium, total	**1.83**	MAC = 7	0.0010	mg/L	2022-11-08	
Uranium, total	**0.00193**	MAC = 0.02	0.000020	mg/L	2022-11-08	
Zinc, total	**0.0099**	AO ≤ 5	0.0040	mg/L	2022-11-08	

Note Descriptions:

HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.

APPENDIX 1: SUPPORTING INFORMATION

REPORTED TO Tony Friesen (Interior Geoscience Inc.)
CARO WO# 22K0663 **REPORTED** 2022-11-09

Analysis Description	Method Ref.	Technique	Accredited	Location
Alkalinity in Water	SM 2320 B* (2017)	Titration with H2SO4	✓	Kelowna
Anions in Water	SM 4110 B (2017)	Ion Chromatography	✓	Kelowna
Coliforms, Total in Water	SM 9222* (2017)	Membrane Filtration / Chromocult Agar	✓	Kelowna
Conductivity in Water	SM 2510 B (2017)	Conductivity Meter	✓	Kelowna
Cyanide, SAD in Water	ASTM D7511-12	Flow Injection with In-Line UV Digestion and Amperometry	✓	Kelowna
E. coli in Water	SM 9222* (2017)	Membrane Filtration / Chromocult Agar	✓	Kelowna
Hardness in Water	SM 2340 B* (2017)	Calculation: 2.497 [total Ca] + 4.118 [total Mg] (Est)	✓	N/A
pH in Water	SM 4500-H+ B (2017)	Electrometry	✓	Kelowna
Solids, Total Dissolved in Water	SM 1030 E (2017)	SM 1030 E (2011)		N/A
Total Metals in Water	EPA 200.2 / EPA 6020B	HNO3+HCl Hot Block Digestion / Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS)	✓	Richmond
Turbidity in Water	SM 2130 B (2017)	Nephelometry	✓	Kelowna

Note: An asterisk in the Method Reference indicates that the CARO method has been modified from the reference method

Glossary:

RL	Reporting Limit (default)
<	Less than the specified Reporting Limit (RL) - the actual RL may be higher than the default RL due to various factors
AO	Aesthetic Objective
CFU/100 mL	Colony Forming Units per 100 millilitres
MAC	Maximum Acceptable Concentration (health based)
mg/L	Milligrams per litre
NTU	Nephelometric Turbidity Units
OG	Operational Guideline (treated water)
pH units	pH < 7 = acidic, ph > 7 = basic
µS/cm	Microsiemens per centimetre
ASTM	ASTM International Test Methods
EPA	United States Environmental Protection Agency Test Methods
SM	Standard Methods for the Examination of Water and Wastewater, American Public Health Association

APPENDIX 1: SUPPORTING INFORMATION

REPORTED TO Tony Friesen (Interior Geoscience Inc.)
CARO WO# 22K0663 **REPORTED** 2022-11-09

General Comments:

For assistance reading your report, please visit
https://www.caro.ca/wp-content/uploads/2020/07/How-to-read-your-report-1.pdf

For information about bacteria in water results, please visit
https://www.caro.ca/you-need-to-know-about-bacteria-in-water-analytical-report/

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Results in **Bold** indicate values that are above CARO's method reporting limits. Any results that are above regulatory limits are highlighted **red**. Please note that results will only be highlighted red if the regulatory limits are included on the CARO report. Any Bold and/or highlighted results do not take into account method uncertainty. If you would like method uncertainty or regulatory limits to be included on your report, please contact your Account Manager:TeamCaro@caro.ca

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APPENDIX 2: QUALITY CONTROL RESULTS

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The following section displays the quality control (QC) data that is associated with your sample data. Groups of samples are prepared in "batches" and analyzed in conjunction with QC samples that ensure your data is of the highest quality. Common QC types include:

- **Method Blank (Blk)**: A blank sample that undergoes sample processing identical to that carried out for the test samples. Method blank results are used to assess contamination from the laboratory environment and reagents.
- **Duplicate (Dup)**: An additional or second portion of a randomly selected sample in the analytical run carried through the entire analytical process. Duplicates provide a measure of the analytical method's precision (reproducibility).
- **Blank Spike (BS)**: A sample of known concentration which undergoes processing identical to that carried out for test samples, also referred to as a laboratory control sample (LCS). Blank spikes provide a measure of the analytical method's accuracy.
- **Matrix Spike (MS)**: A second aliquot of sample is fortified with a known concentration of target analytes and carried through the entire analytical process. Matrix spikes evaluate potential matrix effects that may affect the analyte recovery.
- **Reference Material (SRM)**: A homogenous material of similar matrix to the samples, certified for the parameter(s) listed. Reference Materials ensure that the analytical process is adequate to achieve acceptable recoveries of the parameter(s) tested.

Each QC type is analyzed at a 5-10% frequency, i.e. one blank/duplicate/spike for every 10-20 samples. For all types of QC, the specified recovery (% Rec) and relative percent difference (RPD) limits are derived from long-term method performance averages and/or prescribed by the reference method.

Analyte	Result	MRL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Notes
Anions, Batch B2K0597										
Blank (B2K0597-BLK1)				Prepared: 2022-11-05, Analyzed: 2022-11-05						
Chloride	< 0.10	0.10	mg/L							
Fluoride	< 0.10	0.10	mg/L							
Nitrate (as N)	< 0.010	0.010	mg/L							
Nitrite (as N)	< 0.010	0.010	mg/L							
Sulfate	< 1.0	1.0	mg/L							
LCS (B2K0597-BS1)				Prepared: 2022-11-05, Analyzed: 2022-11-05						
Chloride	15.2	0.10	mg/L	16.0		95	90-110			
Fluoride	4.02	0.10	mg/L	4.00		101	88-108			
Nitrate (as N)	4.05	0.010	mg/L	4.00		101	90-110			
Nitrite (as N)	1.84	0.010	mg/L	2.00		92	85-115			
Sulfate	15.3	1.0	mg/L	16.0		95	90-110			
General Parameters, Batch B2K0743										
Blank (B2K0743-BLK1)				Prepared: 2022-11-06, Analyzed: 2022-11-06						
Turbidity	< 0.10	0.10	NTU							
LCS (B2K0743-BS1)				Prepared: 2022-11-06, Analyzed: 2022-11-06						
Turbidity	43.1	0.10	NTU	40.0		108	90-110			
General Parameters, Batch B2K0844										
Blank (B2K0844-BLK1)				Prepared: 2022-11-07, Analyzed: 2022-11-07						
Alkalinity, Total (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Bicarbonate (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Carbonate (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Hydroxide (as CaCO3)	< 1.0	1.0	mg/L							
Conductivity (EC)	< 2.0	2.0	µS/cm							
Blank (B2K0844-BLK2)				Prepared: 2022-11-07, Analyzed: 2022-11-07						
Alkalinity, Total (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Bicarbonate (as CaCO3)	< 1.0	1.0	mg/L							

APPENDIX 2: QUALITY CONTROL RESULTS

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Analyte	Result	MRL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Notes
General Parameters, Batch B2K0844, Continued										
Blank (B2K0844-BLK2), Continued				Prepared: 2022-11-07, Analyzed: 2022-11-07						
Alkalinity, Carbonate (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Hydroxide (as CaCO3)	< 1.0	1.0	mg/L							
Conductivity (EC)	< 2.0	2.0	µS/cm							
Blank (B2K0844-BLK3)				Prepared: 2022-11-07, Analyzed: 2022-11-07						
Alkalinity, Total (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Bicarbonate (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Carbonate (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Hydroxide (as CaCO3)	< 1.0	1.0	mg/L							
Conductivity (EC)	< 2.0	2.0	µS/cm							
LCS (B2K0844-BS1)				Prepared: 2022-11-07, Analyzed: 2022-11-07						
Alkalinity, Total (as CaCO3)	96.7	1.0	mg/L	100		97	80-120			
LCS (B2K0844-BS2)				Prepared: 2022-11-07, Analyzed: 2022-11-07						
Alkalinity, Total (as CaCO3)	99.0	1.0	mg/L	100		99	80-120			
LCS (B2K0844-BS3)				Prepared: 2022-11-07, Analyzed: 2022-11-07						
Alkalinity, Total (as CaCO3)	99.8	1.0	mg/L	100		100	80-120			
LCS (B2K0844-BS4)				Prepared: 2022-11-07, Analyzed: 2022-11-07						
Conductivity (EC)	1410	2.0	µS/cm	1410		100	95-105			
LCS (B2K0844-BS6)				Prepared: 2022-11-07, Analyzed: 2022-11-07						
Conductivity (EC)	1410	2.0	µS/cm	1410		100	95-105			
Reference (B2K0844-SRM1)				Prepared: 2022-11-07, Analyzed: 2022-11-07						
pH	7.02	0.10	pH units	7.01		100	98-102			
Reference (B2K0844-SRM2)				Prepared: 2022-11-07, Analyzed: 2022-11-07						
pH	7.01	0.10	pH units	7.01		100	98-102			
Reference (B2K0844-SRM3)				Prepared: 2022-11-07, Analyzed: 2022-11-07						
pH	7.02	0.10	pH units	7.01		100	98-102			
General Parameters, Batch B2K0924										
Blank (B2K0924-BLK1)				Prepared: 2022-11-08, Analyzed: 2022-11-08						
Cyanide, Total	< 0.0020	0.0020	mg/L							
Blank (B2K0924-BLK2)				Prepared: 2022-11-08, Analyzed: 2022-11-08						
Cyanide, Total	< 0.0020	0.0020	mg/L							
LCS (B2K0924-BS1)				Prepared: 2022-11-08, Analyzed: 2022-11-08						
Cyanide, Total	0.0204	0.0020	mg/L	0.0200		102	82-120			
LCS (B2K0924-BS2)				Prepared: 2022-11-08, Analyzed: 2022-11-08						
Cyanide, Total	0.0194	0.0020	mg/L	0.0200		97	82-120			
LCS Dup (B2K0924-BSD1)				Prepared: 2022-11-08, Analyzed: 2022-11-08						
Cyanide, Total	0.0203	0.0020	mg/L	0.0200		102	82-120	< 1	10	
LCS Dup (B2K0924-BSD2)				Prepared: 2022-11-08, Analyzed: 2022-11-08						
Cyanide, Total	0.0203	0.0020	mg/L	0.0200		101	82-120	4	10	
Microbiological Parameters, Batch B2K0570										

APPENDIX 2: QUALITY CONTROL RESULTS

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Analyte	Result	MRL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Notes
Microbiological Parameters, Batch B2K0570, Continued										
Blank (B2K0570-BLK1)				Prepared: 2022-11-04, Analyzed: 2022-11-04						
Coliforms, Total	< 1	1	CFU/100 mL							
E. coli	< 1	1	CFU/100 mL							
Blank (B2K0570-BLK2)				Prepared: 2022-11-04, Analyzed: 2022-11-04						
Coliforms, Total	< 1	1	CFU/100 mL							
E. coli	< 1	1	CFU/100 mL							
Blank (B2K0570-BLK3)				Prepared: 2022-11-04, Analyzed: 2022-11-04						
Coliforms, Total	< 1	1	CFU/100 mL							
E. coli	< 1	1	CFU/100 mL							
Blank (B2K0570-BLK4)				Prepared: 2022-11-04, Analyzed: 2022-11-04						
Coliforms, Total	< 1	1	CFU/100 mL							
E. coli	< 1	1	CFU/100 mL							
Blank (B2K0570-BLK5)				Prepared: 2022-11-04, Analyzed: 2022-11-04						
Coliforms, Total	< 1	1	CFU/100 mL							
E. coli	< 1	1	CFU/100 mL							
Total Metals, Batch B2K0967										
Blank (B2K0967-BLK1)				Prepared: 2022-11-08, Analyzed: 2022-11-08						
Aluminum, total	< 0.0050	0.0050	mg/L							
Antimony, total	< 0.00020	0.00020	mg/L							
Arsenic, total	< 0.00050	0.00050	mg/L							
Barium, total	< 0.0050	0.0050	mg/L							
Boron, total	< 0.0500	0.0500	mg/L							
Cadmium, total	< 0.000010	0.000010	mg/L							
Calcium, total	< 0.20	0.20	mg/L							
Chromium, total	< 0.00050	0.00050	mg/L							
Copper, total	< 0.00040	0.00040	mg/L							
Iron, total	< 0.010	0.010	mg/L							
Lead, total	< 0.00020	0.00020	mg/L							
Magnesium, total	< 0.010	0.010	mg/L							
Manganese, total	< 0.00020	0.00020	mg/L							
Potassium, total	< 0.10	0.10	mg/L							
Selenium, total	< 0.00050	0.00050	mg/L							
Sodium, total	< 0.10	0.10	mg/L							
Strontium, total	< 0.0010	0.0010	mg/L							
Uranium, total	< 0.000020	0.000020	mg/L							
Zinc, total	< 0.0040	0.0040	mg/L							
LCS (B2K0967-BS1)				Prepared: 2022-11-08, Analyzed: 2022-11-08						
Aluminum, total	3.99	0.0050	mg/L	4.00		100	80-120			
Antimony, total	0.0384	0.00020	mg/L	0.0400		96	80-120			
Arsenic, total	0.0404	0.00050	mg/L	0.0400		101	80-120			
Barium, total	0.0388	0.0050	mg/L	0.0400		97	80-120			
Boron, total	< 0.0500	0.0500	mg/L	0.0400		106	80-120			
Cadmium, total	0.0389	0.000010	mg/L	0.0400		97	80-120			
Calcium, total	4.08	0.20	mg/L	4.00		102	80-120			
Chromium, total	0.0397	0.00050	mg/L	0.0400		99	80-120			
Copper, total	0.0398	0.00040	mg/L	0.0400		99	80-120			
Iron, total	3.97	0.010	mg/L	4.00		99	80-120			
Lead, total	0.0392	0.00020	mg/L	0.0400		98	80-120			
Magnesium, total	3.89	0.010	mg/L	4.00		97	80-120			
Manganese, total	0.0398	0.00020	mg/L	0.0400		99	80-120			

APPENDIX 2: QUALITY CONTROL RESULTS

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CARO WO# 22K0663 **REPORTED** 2022-11-09

Analyte	Result	MRL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Notes
Total Metals, Batch B2K0967, Continued										
LCS (B2K0967-BS1), Continued				Prepared: 2022-11-08, Analyzed: 2022-11-08						
Potassium, total	4.08	0.10	mg/L	4.00		102	80-120			
Selenium, total	0.0396	0.00050	mg/L	0.0400		99	80-120			
Sodium, total	3.97	0.10	mg/L	4.00		99	80-120			
Strontium, total	0.0398	0.0010	mg/L	0.0400		99	80-120			
Uranium, total	0.0396	0.000020	mg/L	0.0400		99	80-120			
Zinc, total	0.0394	0.0040	mg/L	0.0400		98	80-120			

4.0 STUDY LIMITATIONS

WSP Canada Inc. (WSP) has prepared this technical memorandum in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and geoscience professions currently practicing in British Columbia, subject to the time limits and physical constraints applicable to this technical memorandum. No other warranty, express or implied is made.

The technical memorandum is of a summary nature and is not intended to stand alone without reference to the instructions given to WSP by the Client, communications between WSP and the Client, and to any other deliverables prepared by WSP for the Client relative to the specific site described in the technical memorandum. In order to properly understand the suggestions, recommendations and opinions expressed in this technical memorandum, reference must be made to the whole of the technical memorandum.

WSP cannot be responsible for use by any party of portions of the technical memorandum without reference to the entire technical memorandum and other relevant communications between WSP and the Client.

In preparing this technical memorandum, WSP has relied in good faith on information provided by the individuals and agencies noted in this technical memorandum. We accept no responsibility for any deficiency or inaccuracy contained in this technical memorandum as a result of errors, omissions, misinterpretations or fraudulent acts of the persons or agencies contacted.

The information, recommendations and opinions expressed in this technical memorandum are for the sole benefit of the Client.

No other party may use or rely on this technical memorandum or any portion thereof without WSP's express written consent.

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If new information is discovered in the future, WSP should be requested to re-evaluate the content of this technical memorandum and provide amendments as required prior to any reliance upon the information presented herein.

Interior Geoscience Inc
Anthony Friesen M.Sc., P.Geo
250-306-4477
tony@interiorgeoscience.com

Attachment G – Preliminary Review of the Hydrogeological reports submitted for proposed residential development at 7500 McLennan Rd, RDNO, BC.

DRAFT

TECHNICAL MEMORANDUM

Reference No. 20144760-012-TM-RevA

DATE 15 March 2023

TO Rob Smailes, General Manager, Planning and Building
Regional District of North Okanagan

CC Zee Marcolin, General Manager, Utilities

FROM Mark Bolton, WSP Canada Inc. **EMAIL mark.bolton@wsp.com**

PRELIMINARY REVIEW OF HYDROGEOLOGICAL REPORTS SUBMITTED FOR PROPOSED RESIDENTIAL DEVELOPMENT AT 7500 MCLENNAN ROAD, REGIONAL DISTRICT OF NORTH OKANAGAN, BC

Dear Mr. Smailes,

As requested by the Regional District of North Okanagan (RDNO), WSP Canada Inc. (WSP) has conducted a preliminary review of a hydrogeological report regarding a proposed development at 7500 McLennan Road in RDNO Electoral Area "C" (the Development). This technical memorandum should be interpreted and used in accordance with the limitations and considerations set out in WSP's *Study Limitations*, provided at the end of this memo.

1.0 BACKGROUND AND OBJECTIVE

WSP understands that the Development is located at 7505 McLennan Road, within RDNO Electoral Area "C", has a legal description of Lot 1: Sec 25, Twp 8, ODYD, Plan 2558, Except Plan 37038 and Plan EPP74629, and is 24.21 hectares (ha) in size. The owner proposes to subdivide the parcel into two lots (Lot 1 and Lot 2) under the current zoning of Non-Urban (NU) and then rezone the lots to Country Residential (CR), which would allow for subdivision into a total of eight lots, each 2 ha or larger, to be developed. Each lot would be serviced by a private individual well.

In support of the Development, Interior Geoscience Inc. (IGI) was retained to provide hydrogeological services, as documented in the following reports:

- Hydrogeological Assessment of Groundwater Supply (Well Plate ID Number 66090) in Support of Subdivision Application, at 7500 McLennan Rd, Electoral Area C, in the Regional District of North Okanagan, dated 4 April 2022. (IGI Job Number 2022-006)
- Hydrogeological Assessment of Groundwater Supply in Support of Rezoning Application, at 7500 McLennan Rd., Electoral Area C, in the Regional District of the North Okanagan, dated 5 December 2022 (IGI Job Number 2022-006)

- Hydrogeological Assessment of Groundwater Supply in Support of Rezoning Application, at 7500 McLennan Rd., Electoral Area C, in the Regional District of the North Okanagan, dated 23 January 2023 (IGI Job Number 2022-006)

The objective of this preliminary review was to provide high level comments regarding whether the information provided in the IGI reports is generally consistent with the objectives of proposed changes to the Subdivision Servicing Bylaw for Electoral Area "C", as outlined in Subdivision Servicing Amendment Bylaw No. 2930, 2022 (herein referred to as "the Bylaw Amendment"); this preliminary review is not an independent third-party technical review of the hydrogeological reports. We recognize that the Bylaw Amendment was issued after IGI had conducted the hydrogeological assessment that included a pumping test and was reported in the April 2022 report.

2.0 RESULTS OF PRELIMINARY REVIEW

Based on the preliminary review of the information presented in the IGI reports, the following comments are provided:

- The hydrogeological assessments were prepared by a Qualified Professional, in accordance with the Bylaw Amendment.
- A site plan with the proposed lots is presented by IGI. It is understood that two wells are located at the Development, identified with Well Plate ID (WPID) No.s 47667 and 66090; wells are herein referred to by PID No. The locations of these wells are presented on a map that was generated with iMapBC but are not presented on the site plan, as required by the Bylaw Amendment.
    - IGI did not confirm if the existing wells comply with the minimum construction requirements of the BC Groundwater Protection Regulation (GWPR) and the Bylaw Amendment; however, the logs that were provided by IGI for WPID 47667 and 66090 indicate that each well was completed with a surface seal and more than the minimum casing stickup that is required by the GWPR.
    - As the Development is in the early stages, it is understood that septic systems have not yet been constructed. The Bylaw Amendment will require that septic systems be designed by a Qualified Professional or Registered Onsite Wastewater Practitioner and located with appropriate setbacks from wells.
- IGI did not present water level monitoring for wells at the Development; monitoring for a minimum period of one year is required in the Bylaw Amendment. IGI presented water level data for BC Observation Well 311 (OBW 311), located approximately 2 km from the Development and provide analysis of the data available from 1991 to the time of the report. IGI noted the seasonal fluctuation in water levels and the general recovery of water levels in this well from the lowest reported levels in 2011; however, the bedrock in the area is variable both in terms of lithology and a fault extends north-south between the Development and the area of the OBW 311. Therefore, the water level patterns at OBW 311 may not reflect conditions at the Development.

- Although IGI notes that RDNO Bylaw 2600 currently enables subdivision of lots 2 has in size or larger without provision of a potable water supply (Section 407) if a report is obtained from a Qualified Professional, the Bylaw Amendment requires that a minimum of 6,550 litres per day (1.0 Imperial gallon per minute; I gpm) be demonstrated per parcel. For wells that are proposed as a source of water supply, a pumping test must be conducted.
  - IGI reported that a pumping test was conducted for WPID 66090, located on proposed Lot 1, with details provided in the report dated 4 April 2022:
    - The pumping test was conducted in March 2022. As discussed above, IGI did not provide water static water level monitoring data for WPID 66090. IGI reported that groundwater levels are typically higher in late summer and winter and therefore incorporated an annual fluctuation of 0.5 m into the analysis of the pumping test data.
    - The pumping test program comprised two constant rate pumping tests; one was conducted for a duration of 24 hours at a rate of approximately 9.5 L/min (2.1 I gpm) and a second test was conducted for a duration of 8.5 hours at a rate of 28.4 L/min (6.2 I gpm). The Bylaw Amendment requires that wells completed in bedrock aquifers be tested for a minimum duration of 72 hours.
    - IGI did not present monitoring data for the pumping well for a minimum of one week prior to the pumping test to assess pre-test trends, as is now required by the Bylaw Amendment.
    - IGI analysed the results of the pumping test and estimated the sustainable yield for WPID 66090 to be 0.14 L/s (1.8 I gpm), greater than the minimum per parcel requirement.
    - IGI report that water levels in the pumping well were monitored for periods of 48 and 34 hours following the 24-hour and 8.5-hour pumping tests, respectively. The water level in the pumping well did not fully recover to static conditions during the monitored periods. The Bylaw Amendment requires that, if full recovery is not achieved following pumping, further assessment be conducted by the Qualified Professional. IGI attributed the recovery patterns observed to the well having been unused prior to testing. They also attributed the failure of the well to achieve full recovery to the dual porosity of bedrock, whereby recovery related to the primary porosity (rock matrix) requires a longer time than recovery related to the secondary porosity (fractures).
    - IGI reported that during the pumping test for WPID 66090, water levels were monitored in WPID 47667, meeting the Bylaw Amendment requirement to monitor at least one observation well. The Bylaw Amendment also requires that the observation well(s) must be within 100 m of the pumping well and, for bedrock aquifers, completed within the same fracture network, which is uncertain for WPID 47667 as no response was reported for this well during the pumping test. It is understood that the two wells at the Development are separated by a distance of approximately 300 m. IGI reported that wells that are located on adjacent properties and approximately 100 m from WPID 66090 were not accessible for water level monitoring.
  - IGI did not conduct a pumping test for WPID 47667 because the driller-estimated yield was reported to be 5 US gpm. This estimate is greater than the minimum value of 3 I gpm that was identified in the Subdivision Servicing Bylaw at the time of IGI's report dated April 2023; however, the Bylaw Amendment now requires that a pumping test be conducted for each well to demonstrate that it can satisfy the minimum per parcel requirement.

- IGI report that groundwater samples from WPID 47667 and WPID 66090 exceeded the Guidelines for Canadian Drinking Water Quality (GCDWQ) aesthetic objective (AO) criteria for total dissolved solids (TDS) and the sample from WPID 47667 exceeded the GCDWQ criteria for iron. The samples from both wells exceeded the GCDWQ operational guidance (OG) value for turbidity and IGI noted that the concentration of fluoride in the samples from both wells were equal to (but did not exceed) the GCDWQ maximum allowable concentration (MAC) value. IGI provided links to guidance documents provided by Health Canada regarding treatment for the water quality parameters identified above.

WSP acknowledges that the Bylaw Amendment was issued after IGI had conducted the pumping test for WPID 66090.

3.0 CLOSURE

We trust that this technical memorandum meets your needs at this time. Should you have any questions, please do not hesitate to contact the undersigned.

WSP Canada Inc.

Mark Bolton, MSc, PGeo
Senior Principal Hydrogeologist

Jillian Sacré, MSc, PGeo
Senior Principal Hydrogeologist

MB/JS/jcc

https://golderassociates.sharepoint.com/sites/127973/project files/6 deliverables/3.0_issued/20144760-012-tm-reva/20144760-012-tm-reva preliminary review 15mar_23. docx.docx

4.0 STUDY LIMITATIONS

WSP Canada Inc. (WSP) has prepared this technical memorandum in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and geoscience professions currently practicing in British Columbia, subject to the time limits and physical constraints applicable to this technical memorandum. No other warranty, express or implied is made.

The technical memorandum is of a summary nature and is not intended to stand alone without reference to the instructions given to WSP by the Client, communications between WSP and the Client, and to any other deliverables prepared by WSP for the Client relative to the specific site described in the technical memorandum. In order to properly understand the suggestions, recommendations and opinions expressed in this technical memorandum, reference must be made to the whole of the technical memorandum.

WSP cannot be responsible for use by any party of portions of the technical memorandum without reference to the entire technical memorandum and other relevant communications between WSP and the Client.

In preparing this technical memorandum, WSP has relied in good faith on information provided by the individuals and agencies noted in this technical memorandum. We accept no responsibility for any deficiency or inaccuracy contained in this technical memorandum as a result of errors, omissions, misinterpretations or fraudulent acts of the persons or agencies contacted.

The information, recommendations and opinions expressed in this technical memorandum are for the sole benefit of the Client.

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If new information is discovered in the future, WSP should be requested to re-evaluate the content of this technical memorandum and provide amendments as required prior to any reliance upon the information presented herein.

REGIONAL DISTRICT OF NORTH OKANAGAN

Extract from the Minutes of a Meeting of the

Board of Directors

Held on

Wednesday, March 22, 2023

Bylaw 2850 - Zoning Amendment
MALYAKIN, V., [File No. 19-0906-C-RZ]
7500 McLennan Road, Electoral Area "C"

Moved and seconded
That Zoning Amendment Bylaw No. 2850, 2019 which proposes to rezone the property legally described as Lot 1, Sec 25, Twp 8, ODYD, Plan 2558, Except Plan 37038 and Plan EPP74629 and located at 7500 McLennan Road, Electoral Area “C” from the Non-Urban (N.U) zone to the Country Residential (C.R) zone be given Second Reading and be forwarded to a Public Hearing.

CARRIED

Moved and seconded
That the Public Hearing for Zoning Amendment Bylaw No. 2850 be delegated to the Electoral Area Advisory Committee under Section 231 of the *Local Government Act*.

CARRIED

REGIONAL DISTRICT NORTH OKANAGAN

STAFF REPORT

TO:	**Board of Directors**	**File No:**	**19-0906-C-RZ**
FROM:	**Planning Department**	**Date:**	**February 16, 2023**

SUBJECT: Zoning Amendment Bylaw No. 2850, 2019

RECOMMENDATION:

That Zoning Amendment Bylaw No. 2850, 2019 which proposes to rezone the property legally described as Lot 1, Sec 25, Twp 8, ODYD, Plan 2558, Except Plan 37038 and Plan EPP74629 and located at 7500 McLennan Road, Electoral Area "C" from the Non-Urban (N.U) zone to the Country Residential (C.R) zone be given Second Reading and be forwarded to a Public Hearing; and further,

That the Public Hearing for Zoning Amendment Bylaw No. 2850 be delegated to the Electoral Area Advisory Committee under Section 231 of the *Local Government Act*.

BACKGROUND:

The subject application proposes to rezone an approximately 17 ha property located at 7500 McLennan Road from the Non-Urban (N.U) zone to the Country Residential (C.R) zone. If successful in rezoning the property, the applicant is proposing an eight (8) lot subdivision.

At the Regular Meeting held on December 11, 2019, the Board of Directors considered the application and gave First Reading to the associated Zoning Amendment Bylaw No. 2850, 2019. The Board resolved that Second Reading of Bylaw No. 2850 be withheld until the Regional District completes the Keddleston Groundwater Study and the study has confirmed the adequacy of water supply for the level of potential development in the study area. The Board further resolved that Final Adoption of Bylaw No. 2850 be withheld until the applicant has made suitable arrangements with the Regional District to provide an approximate 0.5 m to 1.0 m wide public hiking trail within a 6 m wide Statutory Right of Way that would link McLennan Road through the subject property to the existing Grey Canal Trail.

At the Regular Meeting held on May 20, 2020, the Board of Directors again resolved that further consideration of Bylaw No. 2850 be withheld until the comprehensive review of the water supply in Aquifer 351 had been completed.

In 2021, the property was sold to new owners. The new owners have indicated they wish to proceed with the rezoning application.

At the Regular Meeting held on December 14, 2022, the Board considered the application and resolved that further consideration of Bylaw No. 2850 be withheld until the applicant has submitted a hydrogeological report that provides an evaluation of how the proposal aligns with the findings and recommendations of the Keddleston Groundwater Study – Phase 2 and which demonstrates:

1. that groundwater sources would be available to service the full buildout potential of the subject property (8 lots) in accordance with the provisions of Subdivision Servicing Bylaw No. 2600; and
2. that the use of the groundwater supplies would not have a negative impact on the use of existing wells that obtain water from Aquifer 351.

DISCUSSION:

In follow-up to the above noted Board resolution, the applicant has provided the attached assessment of groundwater supply by Interior Geoscience Inc. dated January 23, 2023. The report takes into account the Golder Report – Phase 2, providing a comparison of the findings of the assessment for the subject site against the findings and recommendations contained within the Golder Report. The report concludes that "groundwater sources are available to service the full buildout potential of eight lots in accordance with the provisions of Subdivision Servicing Bylaw No. 2600, and the use of groundwater supplies for the proposed development at full buildout (8 Lots), will not have a negative impact on the use of existing wells that are completed into Aquifer 351."

The Planning Department suggests that the applicant has satisfied the Board requirement relating to groundwater availability and the proposals can therefore be given Second Reading. Final Adoption of Bylaw No. 2850 would be withheld until the following condition of the Board has been satisfied:

1. the applicant has made suitable arrangements with the Regional District to provide an approximate 0.5 m to 1.0 m wide public hiking trail within a 6 m wide Statutory Right of Way that would link McLennan Road through the subject property to the existing Grey Canal Trail.

Public Notification

As the subject property is located within Keddleston Groundwater Study Area, it is recommended that Zoning Amendment Bylaw No. 2850 be forwarded to a Public Hearing. This would afford persons that believe they may be affected by the proposal an opportunity to provide comment directly to the Board of Directors. However, as Bylaw No. 2850 is consistent with the policies and land use designation of the Electoral Areas "B" and "C" Official Community Plan, the Board could decide not to hold a Public Hearing and to instead provide notice in accordance with the new provisions of Section 467 of the *Local Government Act* advising the public that the Board of Directors would be considering giving First Reading to Zoning Amendment Bylaw No. 2850 at a future meeting. To do this, First Reading of Bylaw No. 2850 would have to be rescinded as the Bylaw has already received First Reading.

Submitted by:

Heather Shannon
Planner

Reviewed by:

Greg Routley
Deputy Planning Manager

Endorsed by:

Rob Smailes, RPP, MCIP
General Manager, Planning and Building

Approved for Inclusion:

David Sewell
Chief Administrative Officer

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Anthony Friesen M.Sc., P.Geo
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tony@interiorgeoscience.com

January 23, 2023
Job Number 2022-006
Viktor Malyakin (Owner)

7500 McLennan Rd.
Vernon BC.
V1B 3S7

Dear Mr. Malyakin,

Re: HYDROGEOLOGICAL ASSESSMENT OF GROUNDWATER SUPPLY IN SUPPORT OF REZONGING APPLICATION, AT 7500 MCLENNAN RD, ELECTORAL AREA C, IN THE REGIONAL DISTRICT OF THE NORTH OKAKAGAN.

Interior Geoscience Inc. (IGI) has been retained to complete a hydrogeological assessment of groundwater resources to support a rezoning application, at 7500 McLennan Rd in Electoral Area 'C' within the Regional District of the North Okanagan (RDNO).

1. PROPERTY INFORMATION

The proposed parcel (the Site) to be rezoned is located north of the City of Vernon at 7500 McLennan Rd. Vernon BC. Legal descriptions: Lot 1: Sec 25, Twp 8, ODYD, Plan 2558, Except Plan 37038 and Plan EPP74629. General location of proposed rezoning is shown in Figure 1. The parcel of land being considered currently comprises one lot totaling 24.21 ha in size. Please note, that it is our understanding that the client is currently in the process of subdividing this parcel into two lots under the current zoning, and this assessment is intended to support the rezoning application of both lots once they have been established. A site plan showing the proposed two lot subdivision is provided in Attachment A.

The proposed rezoning is from Non-Urban (NU) to Country Residential (CR), which is the O.C.P designation for the subject parcel. The rezoning would allow for a total of **8 lots**, each 2 ha or larger in size at presented in Attachment B. Each of the lots is to be serviced by individual wells that would provide potable water to each future residence.

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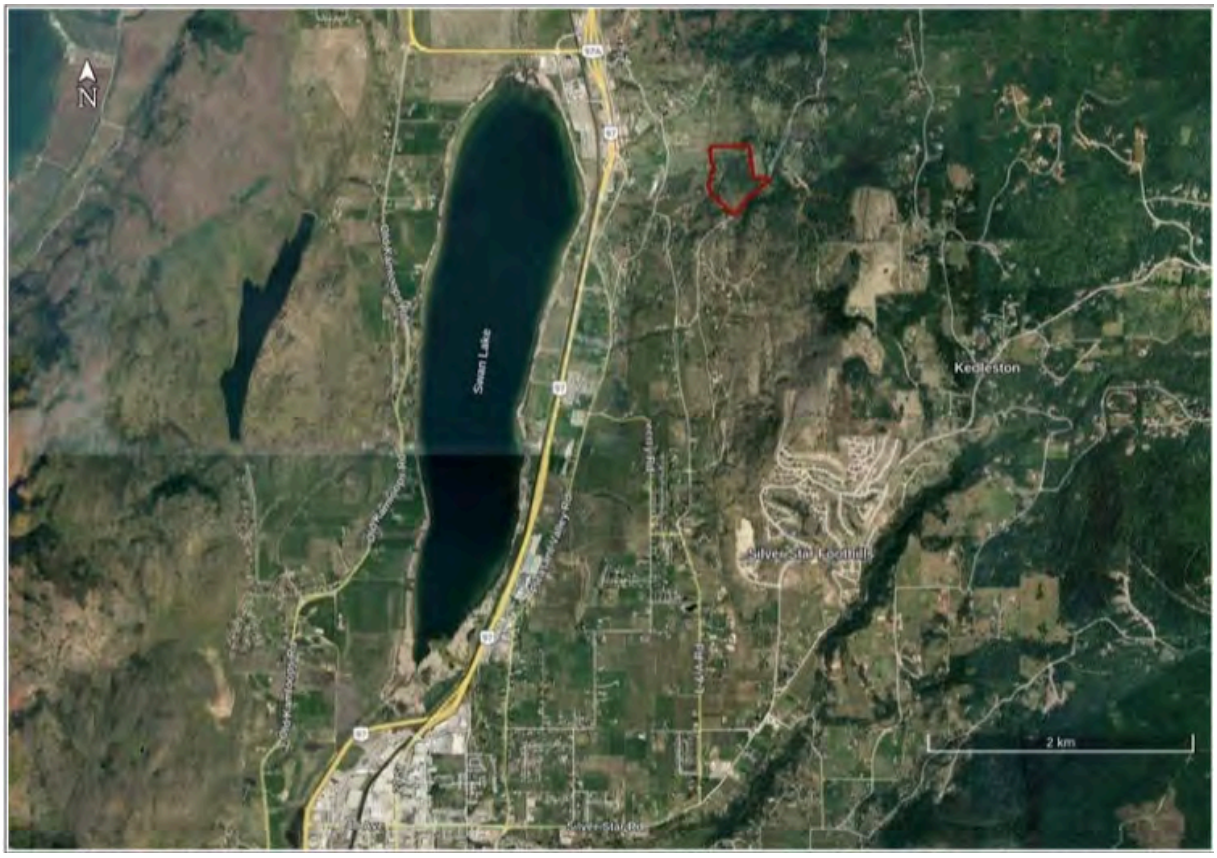

Figure 1: Subject Property Location in relation to Vernon and Swan Lake.

2. OBJECTIVES AND REGULATORY FRAMEWORK

The purpose of this assessment is to evaluate the availability of potable water supplies for the proposed development against the RDNO bylaw 2600 section 406 and 407, which pertains to private water sources from proposed subdivisions. Section 406 states that if the proposed water source is a groundwater well then there must be evidence that each well can produce 6,550 litres/day [1.0 Imperial gallons/minute (I gpm)] year-round, that the water be potable, and that the well not interfere with neighbouring wells. Section 407 stipulates, that in cases where proposed lots are 2 ha (4.942 acres) or larger (which applies to this project) a hydrogeological report that addresses general groundwater availability is typically acceptable prior to rezoning approval. Either before or after final subdivision approval, water sources (wells) must still be installed and quantity and potability confirmed, prior to final subdivision and/or a building permit being issued.

3. FUTURE SUBDIVISION WATER SUPPLY REQUIREMENTS

Assuming 6 additional lots (This assumes the approval of the ongoing subdivision application), this translates to a potential groundwater requirement of 52,400 L/day or about 9.6 US gpm. This flow of water must be available year round and not cause significant interference between wells (i.e. when pumping from a well or wells causes an unacceptable water level drop in a nearby well)

or surface water. An assessment of the potential effects of seasonal variations in groundwater levels, where such seasonal data are available, is also considered during the hydrogeological assessment for rural subdivision wells.

This report details the findings of our assessment.

4. SCOPE OF WORK

IGI conducted the following work program to complete the hydrogeological evaluation and report:

- Assembled and reviewed available data including reports and well logs for the area from the Ministry of Environment, and weather/climate data from Environment Canada.
- Reviewed the conceptual layout of the subdivision as shown on the attached site plan.
- Assembled and reviewed existing reports on wells drilled on the subject property and neighbouring properties.
- Reviewed Ministry of Environment aquifer mapping for the area.
- Assessed groundwater availability / potential on the proposed new lots;
- Contrasted the finding of this assessment, with the Keddleston Groundwater Study-Phase 2 (2022 Golder), and
- Prepared this hydrogeological report for submission to the RDNO, signed off by a B.C. registered professional geoscientist.

5. SITE DESCRIPTION AND GEOLOGICAL SETTING

Site Physiography
The proposed development is located the approximately 5 km northeast of the City of Vernon on the east side of the valley overlooking Swan Lake to the west. The site itself is sloped east to west with elevations ranging from 600 m asl on the west boundary to 655 m asl at the most eastern point. The site comprises some cleared grassland areas situated between mature forested areas. The land surrounding the subject parcel is primary acreage estates with similar vegetation.

Climate normal data are available for 1981-2010 from the North Vernon climate station (Climate ID 1128583), located at 50º 20’39.600” N and -119º 16’ 17.000” W, at an elevation of 538 m asl (Table 1). According to the climate normal data, daily average temperatures range from -2.8 ºC in January to 21.0 ºC in July, with an average annual temperature of 8.8ºC. The average annual precipitation is 487.0 mm, with the majority occurring as snowfall from October to April (142.1 cm) and rainfall year-round (344.9 mm) (ECCC 2022).

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Table 1: Summary of Climate data from Climate Station ID 11258583

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	
Temperature													Yearly Average
Monthly Ave (C°)	-2.8	-0.2	4.2	9.4	13.9	17.4	21.0	20.5	15.3	7.9	1.8	-2.2	8.8
Precipitation													Yearly Total
Rainfall (mm)	11.6	11.7	17.0	27.2	46.3	49.6	35.4	31.9	32.7	40.7	31.1	9.7	344.9
Snowfall (cm)	40.5	13.5	11.7	1.8	0.0	0.0	0.0	0.0	0.0	0.9	26.5	47.3	142.1
Total (mm)	52.2	25.2	28.7	29.0	46.3	49.6	35.4	31.9	32.7	41.5	57.5	57.0	487.0

6. GEOLOGY

Bedrock

The proposed development is completed on the boundary of two bedrock formations. The formation that underlies much of the site is defined as a metamorphic rock within the Silver Creek formation from the Proterozoic to Paleozoic period. The formation is described as an undivided quartz felspathic gneiss, biotite-quartz schist, with lesser carbonaceous schist and marble (ENV 2022). The bedrock formation underlying the western portion of the site is defined as the Chase formation consisting of white to light grey, cliff-forming, calcareous quartzite having a coarse, pitted texture on the weather surfaces. There is a mapped north south fault that runs just east of the proposed development (Figure 2). This is relevant because generally bedrock near a fault zone has likely been subjected to increased geologic stresses, and as a result, an increase in fracturing can occur, along with an increase in porosity within the bedrock. Based on the well testing program completed for this project (See subsequent sections of this report) and the higher reported yields of wells at in the area, it appears that this may be the case.

Surficial Geology

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The overburden at the location of the water supply wells is not mapped; however, available well logs in the area indicate about 10-12 m of silt, sand and gravel with some clay material (till) above bedrock, which is likely a product of glacial activity (ENV 2022).

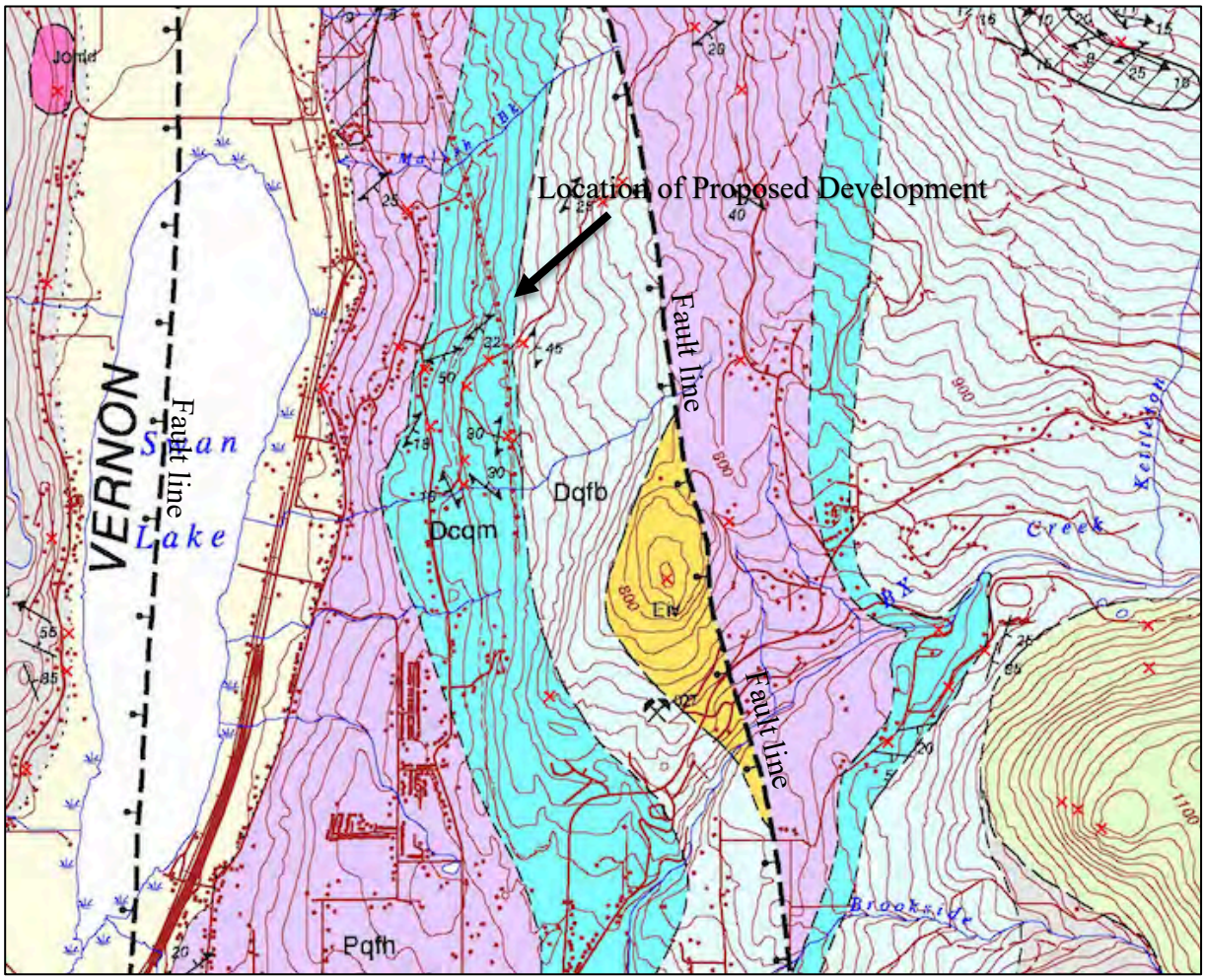

Figure 2: Geological mapping for the proposed development, showing parent bedrock material and fault locations nearby the proposed development. (Thompson and Unterschutz, 2004)

7. AQUIFER AND WELLS

Aquifer

The proposed development is underlain by mapped Aquifer 351, which is a bedrock aquifer, 21.8 km^2 in area and extends from Swan Lake to the west, to Silverstar Rd to the south, and to Silverstar Mountain Resort to the east (Figure 3). It is identified as having low demand, low vulnerability and low productivity (ENV 2022). Based on topography and static water levels in the mapped wells, it is reasonable to assume that the general flow direction in the aquifer is

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east to west. Recharge to Aquifer 351 occurs through direct infiltration of rainfall and snowmelt, along with losses from creeks and streams that flow over the aquifer. Aquifer 351 has a total of 148 wells that have been correlated to this Aquifer. Of these wells only 5 have been licenses for commercial use, none of which are assign for agricultural purposes. For the whole aquifer, reported well yields range from 0.27 L/s to 0.07 L/s with an average yield of 0.1L/s (compared to the Bylaw rate of 0.076 L/s).

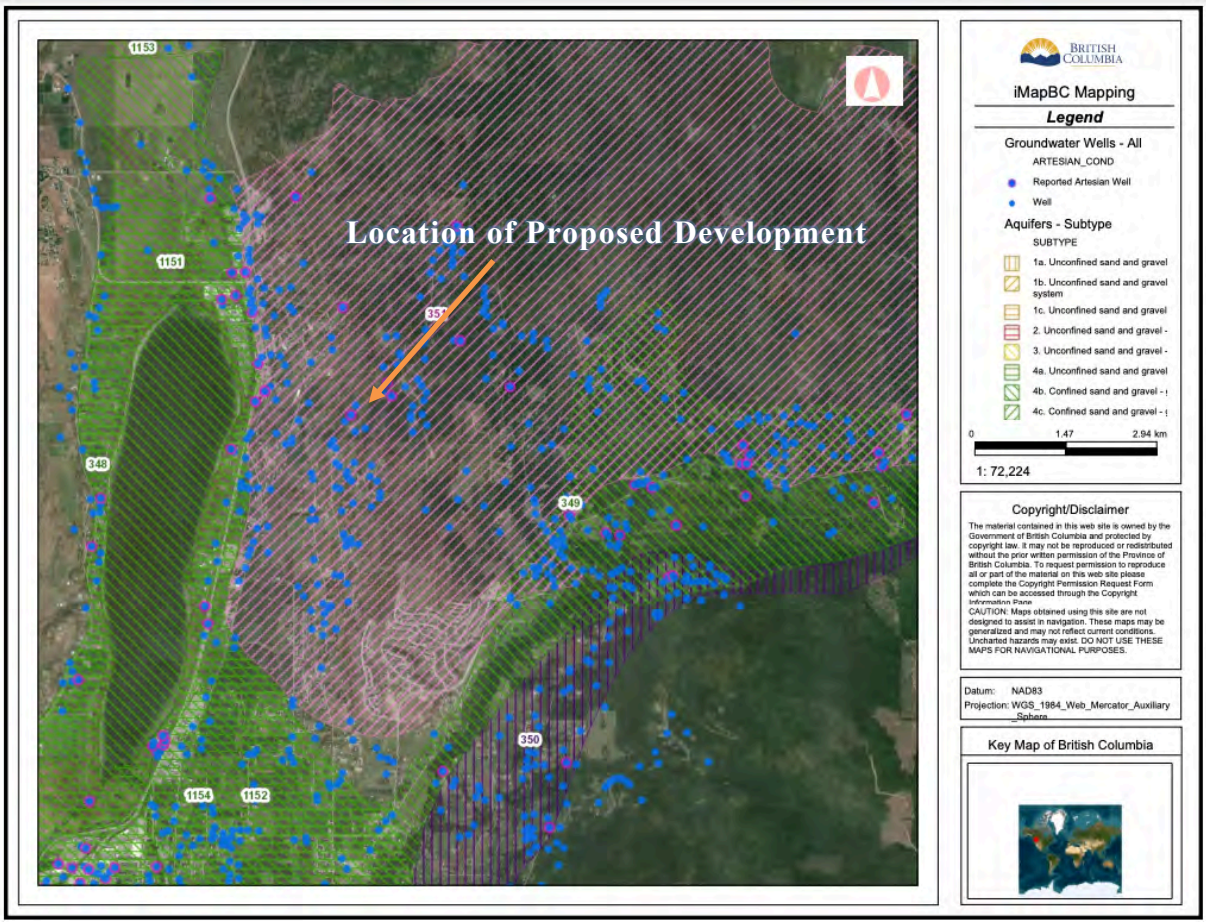

Figure 3: Image showing the Mapped aquifer 351 and wells in relation to the subject site.

Figure 4 (below) presents the approximate location the mapped fault zone and the mapped wells with their corresponding estimated well yields in the area. The strong correlation to the significantly higher estimated yield of wells that are near the fault line is further evidence that the faulting in this area has clearly resulted in Aquifer 351 being more productive in this zone.

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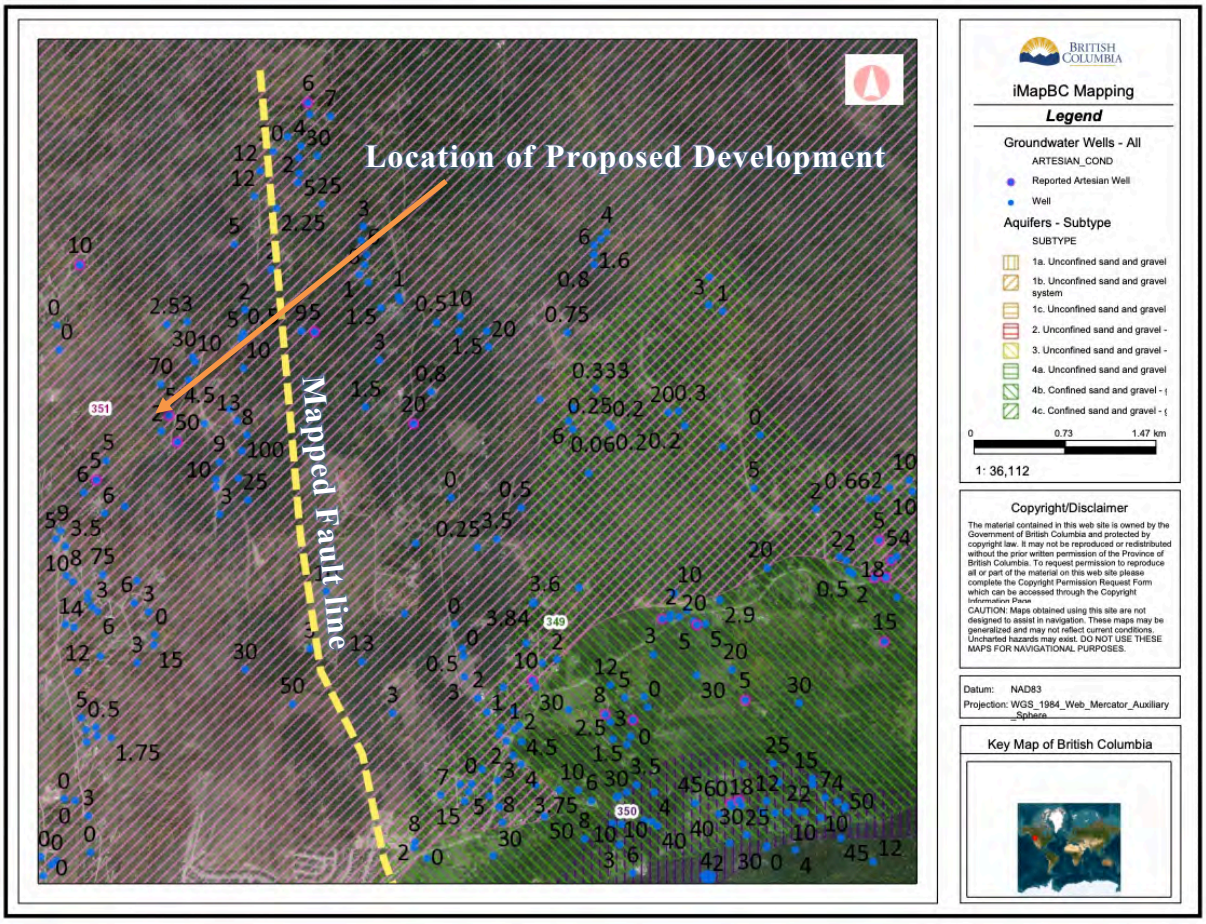

Figure 4: Images showing the location the mapped fault line near the proposed development, and drillers estimated yields in US gpm.

There are two existing wells on the property. Well Plate Identification (WPID) 47667 which is located at the southwest boundary of the parcel (lot 1), and WPID 66090 which is located at the southeast corner of the site, on the future lot 2 (Well logs Attached). As part of an earlier assessment, WPID 66090 was pump tested to determine the long-term sustainable yield of the well (IGI, 2022). At this time, based on the CPCN method, the sustainable yield was calculated to be an estimated 0.23 L/s (4.0 US gpm). To account for the seasonal variability in the water levels and well interference, a 30% safety factor as per the CPCN guidelines. After the 30% safety factor was applied, the sustainable pumping rated calculated is 0.16 L/s (2.5 US gpm). Or 13,827 L/day (2.1 times the bylaw requirement). WPID was not tested, due to the fact that it meets the quantity requirement of the bylaw on account of having drillers estimate of 5 US gpm (27,360 L/day) (4.2 times the bylaw requirement).

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There are an additional 21 mapped wells located within 500 m of the proposed development. The nearest wells (WTN 62362 and WTN 49632) are located 98 m northeast and 105 m east of subject well, respectively. The average yield for each of the wells within 500 m of the subject well is 95,904 L/day (14.6 times the bylaw rate). A summary of the onsite wells and the neighbouring wells is presented in Table 2 below and presented in Figure 4.

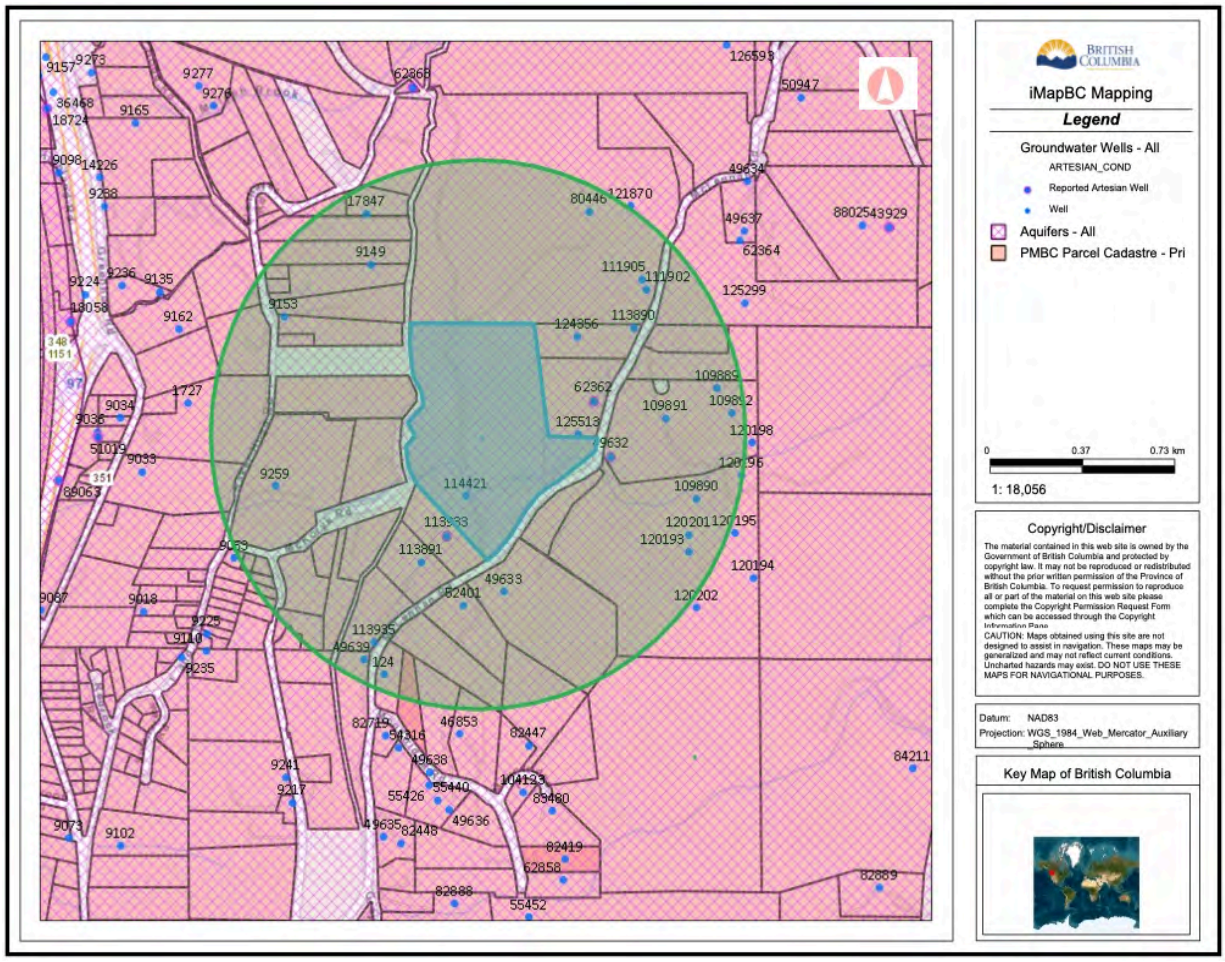

Figure 4: Image showing Mapped aquifers, and surrounding wells.

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Table 2: Summary of wells located on the Subject Parcel

Well Tag Number	Well Plate ID Number	Finished Well Depth (m)	Static Water Level (m btoc)[1]	Depth to Bedrock (m bgs)	Estimated Well Yield L/Day (US gpm)
Well located within the subject Development					
125513	66090	152.0	4.36	10.67	13,824 (2.5)
114421	47667	67.10	23.16	5.00	27,216 (5)
Wells located within 500 meters of Proposed Development					
124356	62172	153	24.08	5.49	381,024 (70)
113890	47649	183	31.09	9.14	24,494 (4.5)
111905	39422	128	30.78	2.13	163,296 (30)
111902	39421	122	31.09	4.27	54,432(10)
120202	50399	73	19.14	5.49	16,330 (3)
120193	50393	91	19.58	1.83	54,432 (10)
120201	50398	104	20.11	4.88	8,162 (1.5)
120195	50395	110	NA	3.048	13,608 (2.5)
114421	47667	67	23.16	1.52	27,216 (5)
109890	38543	55	14.94	0.91	48,989 (9)
120196	50396	69	0.91	2.13	544,320 (100)
120198	50397	79	3.66	6.40	43,546 (8)
109891	38542	67	11.89	23.77	163,296 (30)
109892	38541	61	6.09	14.33	70,762 (13)
109889	38544	104	33.83	11.58	8,165 (1.5)
113891	47647	140	28.35	NA	32,659 (6)
113933	47648	55	NA	3.66	27,216 (5)
52401	NA	49	NA	NA	32,659 (6)
49633	NA	73	NA	NA	NA
49632	NA	64	NA	NA	272,160 (50)
62362	NA	94	NA	NA	27,216 (5)
AVERAGE YIELD ALL WELLS					95,904 (18.5)

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8. SEASONAL VARIATION AND WELL INTERFERENCE IN GROUNDWATER WELLS

Season Variation

Groundwater levels in Aquifer 351 are monitored by the Ministry of Environment at Observation Well 311 (OBW 311) which is located 2 km southeast of the proposed development on Keddleston Road. Water levels in OBW 311 have been monitored since 1991 to present, with a gap in the data from 2001 to 2006. Figures 6 and 7, below, present water levels in OBW 311 over the period of record. Groundwater levels in OBW 311 are observed to fluctuate between 0.3 and 0.5 annually, with the lows occurring in the late winter to seasonal highs that occur in summer. Over the period of record, groundwater levels have fluctuated more significantly. After rising a little between 1991 and 1998, groundwater levels appear to have steadily declined on the order of roughly 2 m, to 2011. After 2011 until present, groundwater levels appear to have recovered ~2.5 m and are currently higher than at any other time in the recorded history of the well. The average available drawdown (defined as the difference between the static water level and the likely depth of pump intake) is 75 m or more, which is sufficient to support the well pumping for the household use with an allowance of season variation of 0.5 m.

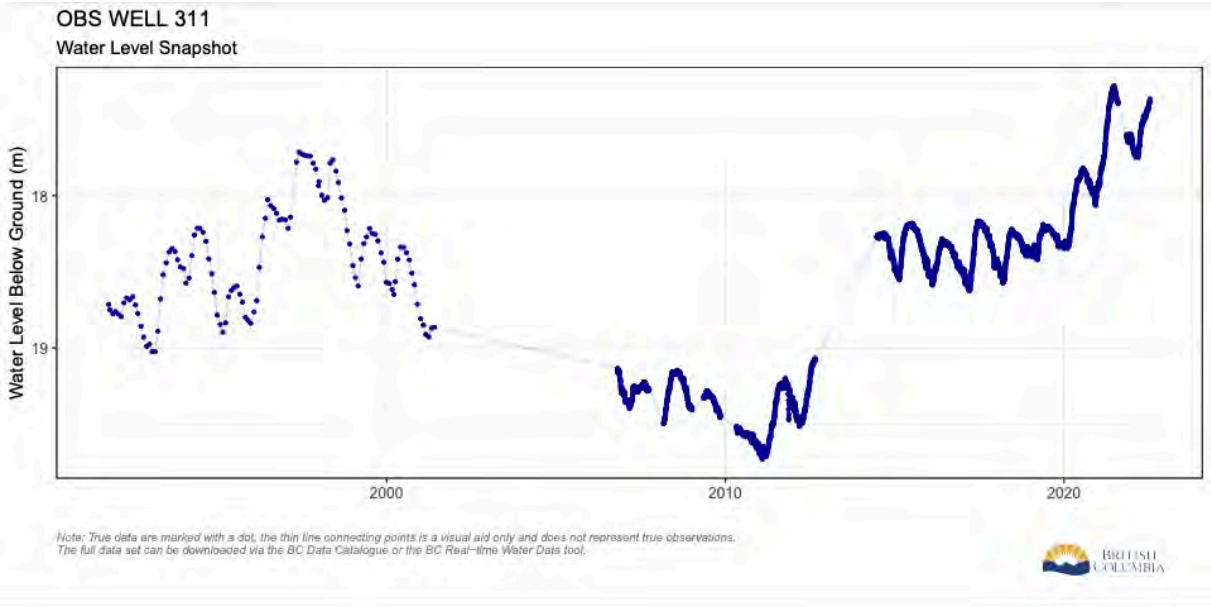

Figure 6: Plot of water levels over time in observation well 311.

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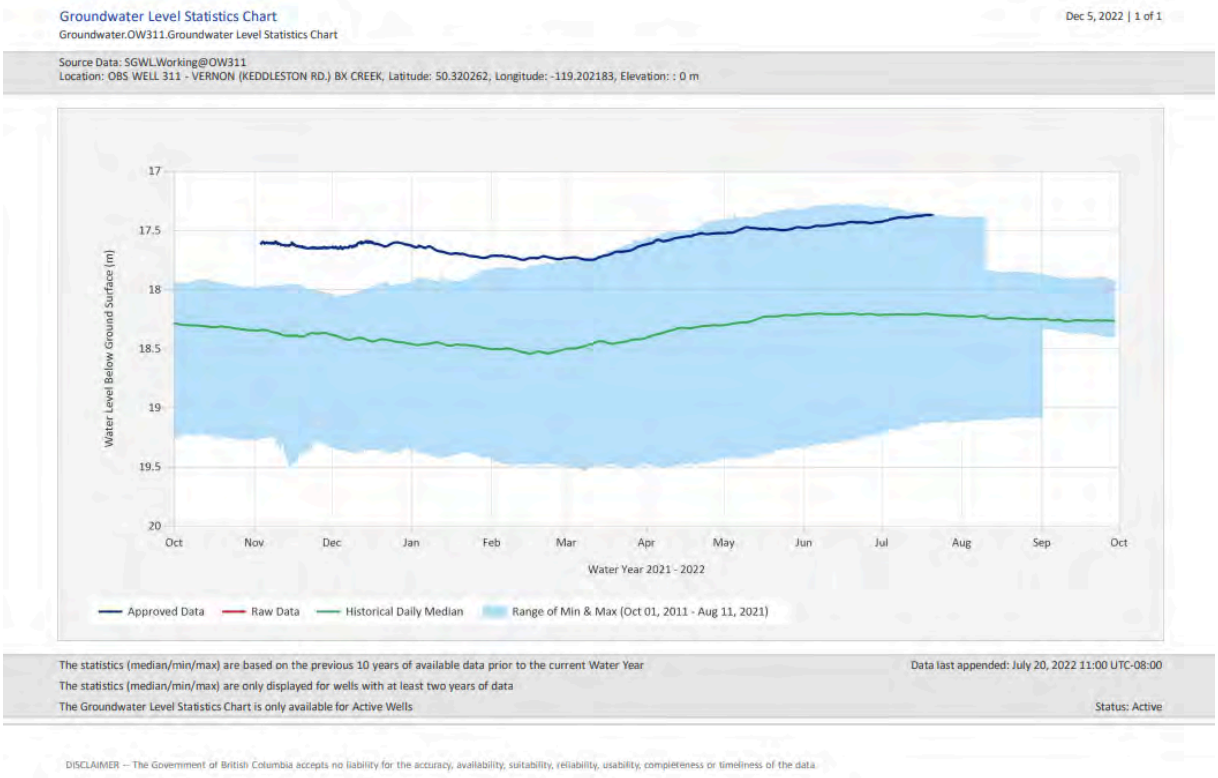

Figure 7: Plot showing the Annual statistical Hydrograph for Observation Well 311, for 2011 to 2021.

Well Interference

The reported well yields combined with the amount of available drawdown indicate that pumping the wells at the bylaw rate will not cause excessive well interference. During the pumping test on WPID 66090 the groundwater levels in WPID 47667 were monitored, in which no change in groundwater level was observed during the pumping test. This indicates that the water bearing fractures in each of the wells are either not connected or both the radius of influence for the duration of the pumping test, and as a result, the sustainable pumping rate is inclusive of this factor.

9. WATER QUALITY ASSESSMENT

As part of the subdivision process water quality samples were taken from both of the wells located on the subject site. WPID 66090 was sampled during the pumping test program and WPID 47667 was sampled on November 3, 2022. Water quality results were compared to GCDWQ described as either “maximum acceptable concentrations” (MAC), “aesthetic objectives” (AO) or operational guidance value (OG). The MAC guidelines are health-based and are determined based on the known health effects associated with the substance. The AO guidelines apply to those variables that affect taste or laundry (e.g. by staining), but do

not pose a health hazard. The OG guidelines are established based on operational considerations regarding treatment requirements. The laboratory results are included as Attachment D.

There were no exceedances of the MAC in either of the wells, indicating the water quality in the area is quite good. However, there were some exceedances of the Aesthetic Objectives and Operational guideline in both wells. Total dissolved solids (TDS) concentrations and Turbidity exceeded the guidelines in both wells and Iron concentrations exceeded the AO guiltiness in WPID 47667. Table 3 outlines the exceedances in both wells (Health Canada 2020).

Table 3: Summary of exceedances the GCDWQ in WPID 66090 and WPID 47667

Analyte	Guideline Value	Guideline Type	WTN 66090	WPID 47667
Total Dissolved Solids	<500 mg/L	AO	610 mg/L	619 mg/L
Turbidity	<1 NTU	OG	12.4 NTU	2.61 NTU
Iron	0.3 mg/L	AO	0.293 mg/L	0.469 mg/L

Elevated TDS concentrations can be naturally occurring but can affect taste and cause excessive scaling of water pipes, boilers, and appliances (Health Canada 1991).

The turbidity was high in all nine wells and exceed the GCDWQ operational guidance of 1.0 NTU. In some cases, turbidity is an indication of natural-occurring organic and/or inorganic particles in the water (e.g., metals, organics, and/or microorganisms). It may also be the case that much of the turbidity is a result of residual fines from the drilling process still present in the wells, and these may clean up with additional pumping when the permanent pump is installed. Particles can harbor microorganisms and shield them from disinfection. For operational efficiencies, Health Canada suggests turbidity should be below 1.0 NTU in groundwater but that a responsible party may choose to allow turbidity increases for individual systems, in light of a risk assessment that takes into account local knowledge of the system's capabilities and performance (Health Canada 2012). Turbidity does not have a maximum acceptable concentration (health-based) guideline.

High levels or iron can cause staining of distribution lines/appliances and laundry, and can result in an undesirable taste, 2 and are already being treated for with the current treatment system located in the pump house. For more information, read the Health Canada Guideline Technical Documents for Iron. See the hyperlinks in the footnotes below.

Helpful guidance documents for the treatment of the exceeding parameters are available on Health Canada's website, as follows:

TDS (Health Canada 1991): https://www.canada.ca/en/health-canada/services/publications/healthy-living/guidelines-canadian-drinking-water-quality-guideline-technical-document-total-dissolved-solids-tds.html.

Turbidity (Health Canada 2012): https://www.canada.ca/en/health-canada/services/publications/healthy-living/guidelines-canadian-drinking-water-quality-turbidity.html.

Iron (Health Canada. 1987) Guidelines for Canadian Drinking Water Quality: Guideline Technical Document – Iron. Available at: https://www.canada.ca/en/health-canada/services/publications/healthy-living/guidelines-canadian-drinking-water-quality-guideline-technical-document-iron.html

It should be noted that although not in exceedance of the MAC, fluoride concentrations were measured to be equal to the MAC of 1.5 mg/L. Helpful guidance documents for the treatment of fluoride are available on Health Canada's website, as follows:

Fluoride (Health Canada 2010): https://www.canada.ca/en/health-canada/services/publications/healthy-living/guidelines-canadian-drinking-water-quality-guideline-technical-document-fluoride.html.

10. REVIEW OF 2022 GOLDER REPORT (KEDDLESTON GROUNDWATER STUDY-PHASE 2)

The RDNO has published several recent studies focusing on the groundwater availability from provincially mapped aquifers 349, 350 and 351 including, Associated Engineering 2007, Golder 2020, and most recently Golder 2022 (Keddleston Groundwater Study-Phase 2). Based on the most recent RDNO Staff report (File No: 22-0403-C-TA) from November 28, 2022, it is our understanding that the RDNO planning department has recommended that future hydrogeological studies in this area specifically address Phase 2 of the Keddleston Groundwater Study (Golder 2022), and therefor was the focus of this background review.

The focus of the Golder study was to assess the water supply wells in the Keddleston area and associated groundwater withdrawals from the local aquifers.

In summary, the 2022 Golder report was based primarily on a review of climate data, existing well logs and aquifer mapping data, land use data, feedback from well owners in study area by way of a well survey, two 24-hour pumping tests, and seven months of water level data from 16 monitoring wells located throughout the study area.

The study concludes that with respect to aquifer 351 (the aquifer underlying the subject site), when accounting for full buildout of the existing lots, and 50% of the ALR land being irrigated, approximately 49% - 60% of the water was predicted to be withdrawn relative to aquifer recharge. It goes on to state that if irrigation use is applied to 100% the agricultural land within the study area, this estimate increases to 147%-188% of aquifer recharge.
It further, concludes that the areas of Wilson-Jackson-Upper, Keddleston-Clearview Road, should be considered limited in available groundwater, and infers that western (downgradient), and eastern (upgradient) portions of the aquifer may be limited in their groundwater availability, and further assessment should be completed to prove water in these areas before further development is approved.

Specific to the 'Western' (downgradient) portion the Aquifer 351 which includes the location the proposed development, Section 7.2.4 of the Golder report indicates that these conclusions are based on the following:

- seven months of water level data shows, significant seasonal variation in water levels in two of the monitoring wells (120 and 189) in this area, which the report infers that may be due to higher usage as corroborated by the relatively higher numbers of residential properties in this area, and

- two well survey responses reported a water shortage,

- the fact that the western portion is downgradient of the two areas that are stated to be limited in available groundwater supply.

In review of Golder report, IGI feels that several of the assumption/conclusions made in the report, do not accurately represent the aquifer conditions at the location of the subject site, for the following reasons:

- The water balance presented in the Golder report assumes that at the low end, 50% of all the ALR land within the study area is being irrigated, and at the high end, 100% of the ALR is being irrigated. It also assumes that at the high end, every parcel of land within the study area, is currently using the full 6,550 L/day as per the applicable bylaw. However, based on the fact that there are only a total of 7 groundwater licenses registered within the study area, none of which are registered for irrigation purposes (Env 2022), and the likely scenarios that typical household use in rural areas is generally more in line with the 2.27 m^3 /day guidelines used in most of the other electoral areas within the RDNO, it seem highly likely that the upper bounds of Golder's water budget does not represent the actual use. It is also worth noting, that the Ministry has identified the BX Creek watershed as "Fully Recorded", which generally suggests that no more groundwater licenses will be allocated to this watershed going forward.

- The Golder study reports that two well surveys from the 'Western' portion of Aquifer 351, reported to have water issues. Golder uses these two responses, as evidence of a general lack of water in the area. However, in both cases, the wells, are reported to be less than 50 m deep (47 m and 49 m respectively), which is much shallower than the average depth of mapped wells in the within 500 m of the proposed development (84.7 m bgs). It should be noted that the report mentions that one of these wells was drilled deeper, but there is no mention if whether it resulted in a higher yield.

- The Golder report relies heavily on the upper estimates of water usage for the water budget to conclude that water availability may be limited for whole of Aquifer 351. This approach fails to consider that the 'Western' portion of the aquifer is within a different catchment, is characterized by differences in geology/hydrogeology then the remainder of the aquifer. Although not addressed specifically in the Golder report, there is a mapped fault zone that runs right between the Wilson-Jackson-Upper, Keddleston-Clearview Road and the 'Western' Portion of the aquifer (Figure 2). This is reflected in the Cross-section B-B' presented on Figure 6 of the Golder report with the two wells located on McLennan Rd (896-62006 and 896-50394) showing a higher number of water bearing fractures then the wells further to the east. This is also seen in well log for WPID 66090 located on the subject site which reports multiple water bearing fractures from 30 m to 152 m bgs. The impact of this fault zone is reflected in the stark difference in estimated wells yields between the wells located near the fault zone, and the estimated yield of wells further to the east. Using Figure M (Golder 2022), as a guide, the Ministry well database indicates that the average reported well yield for the wells in the areas of concern is 2.4 US gpm. In contrast, the average yield for the wells in the 'Western' portion of the Aquifer have an estimated yield is 11.7 US gpm (Figure 4).

- The Golder study makes conclusions on the seasonal variability of water levels in the aquifers based on data from a single year between May and December (7 months). Interestingly, although data from Observation Well 311 is included in the report, which shows a general increase in groundwater levels over the last 10 years despite ongoing development during this time, no conclusions are made based on this data. With respect water level data from the four wells located on McLennan Rd which represent trends in the 'Western' portion of Aquifer 351, two of the wells showed little to no overall change in the water levels, and the other two showed significant increases over the same period, with no correlation between any of these wells. The report goes on to conclude that the higher variability in reported well yields and seasonal water levels in the 'Western' portion of Aquifer is likely a result of higher use based on a higher number of residences in this area. In contrast, IGI believes that it is more appropriate to interpret this difference as a reflection of being in a different catchment, different geological conditions, since the wells density doesn't seem to be any higher in one area over the other.

11. CONCLUSIONS AND RECOMMENDATIONS

Based on the results of this hydrogeological assessment, it is reasonable to conclude that groundwater sources are available to service the full buildout potential of eight lots in accordance with the provisions of Subdivision Servicing Bylaw No. 2600, and the use of groundwater supplies for the proposed development at full buildout (8 Lots), will not have a negative impact on the use of existing wells that are completed into Aquifer 351. The following conclusions support this assessment:

- Based on existing well data, hydrogeological conditions underlying the Site appear to be favorable for the development of wells capable of meeting the RDNO bylaw production rate of 6,550 litres/day (1.2 US gpm) without causing problems of well interference with nearby wells or surface water.
- Accounting for seasonal variation and well interference, the existing on site have an estimated yield of 13,824 and 27,216 liters per day. Just these two wells are enough water to supply 6 of the 8 proposed lots base the required bylaw amount of 6,550 L/day.
- Future wells drilled on the Site would likely encounter Aquifer 351, which based on the evidence looks to be capable of supporting additional drilled wells used for domestic water supply for the proposed development of the eight lots.
- In order to penetrate water-bearing fractures, and to create sufficient available drawdown, the likely depth of wells drilled on the Site is expected to range from approximately 65 to 150 m;
- Due to large available drawdown in the surrounding bedrock wells, and the seasonal fluctuations observed in observation well 311, seasonal variation will likely not be an issue in any of the future potential wells drilled on site.
- Water quality results from the existing wells indicate that there are no exceedances of the MAC guidelines, but there are some exceedances of the AO and OG guidelines that may result in some level of treatment being necessary to optimize system operations.
- The efforts and conclusions of the 2022 Golder report are primarily focused on the areas of Wilson-Jackson-Upper, Keddleston-Clearview Road, and include little evidence to support the conclusions made with respect to the ‘Western’ (downgradient) portion of Aquifer 351. Although, no doubt there are portions of Aquifer 351, and/or individual wells that may be limited with respect to groundwater availability, the fact that the proposed development is within a separate catchment

from the remainder of Aquifer 351, with evidence of highly fractured bedrock as a result of a known fault in the area, suggests that the assumptions that may be applied to some areas of Aquifer 351 are not entirely relevant to the aquifer conditions near the proposed development.

Based on the results of this hydrogeological assessment, IGI provides the following recommendations and treatment options:

- Permit the subject parcel of land to be rezoned to allow for the potential to develop the land into a maximum buildout of 8 lots.
- After drilling, well drillers reports should be reviewed by a qualified professional, and any well with a driller-reported yield less than 3.0 Imperial gpm (especially bedrock aquifer wells) should be tested for a minimum of 48-72 hours to confirm capacity and potability, with oversight and reporting of the test(s) provided by a qualified professional
- Locate wells so that they are at least 50 m (165 ft) from each other and from neighbouring wells, if possible, to minimize the potential for well interference; and
- Locate wells at least 30 m (100 ft) from existing or proposed septic tanks and sewage disposal fields.

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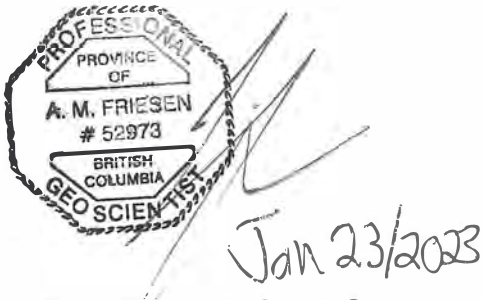
12. CLOSURE

This report was prepared for Victor Malyakin to provide a hydrogeological assessment in support of a rezoning application at 7500 McLennan Road, in the North Okanagan Regional District.

The services provided by Interior Geoscience Inc. The preparation of this report was conducted in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions. No other warranty expressed or implied is made.

Respectfully submitted,



Tony Friesen M.Sc., P.Geo
Hydrogeologist

Permit To Practice Number 1004322

Attachments:

Attachment A – Site Plan showing proposed two Lot subdivision
Attachment B – Site Plan showing proposed layout for 8 lots.
Attachment C – Drillers Logs for WPID 66090 and WPID 47667.
Attachment D – Laboratory reports

References

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Attachment A – Site Plan showing proposed two Lot subdivision

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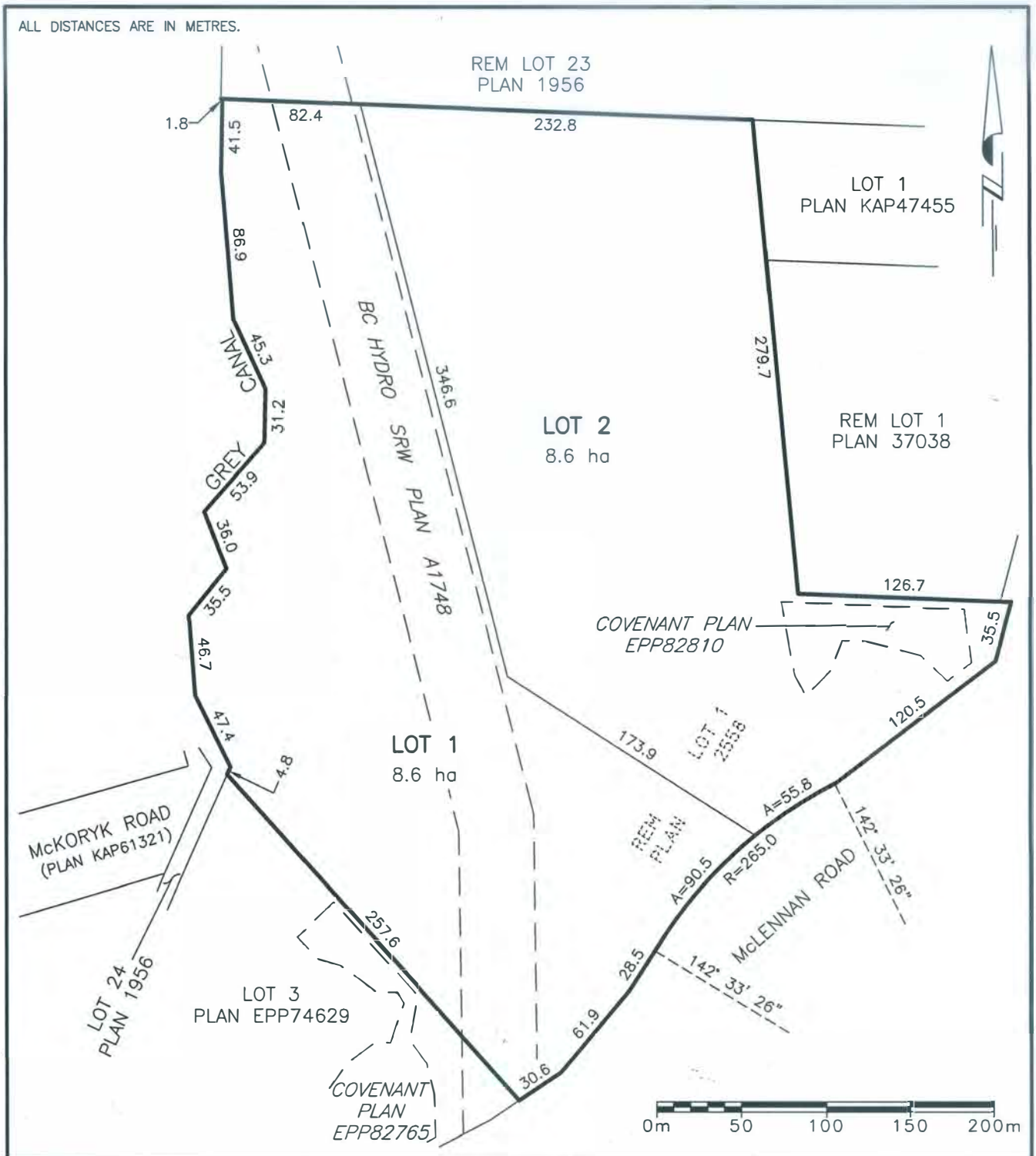

PLAN OF PROPOSED SUBDIVISION OF LOT 1, PLAN 2558, SEC 25, TP 8, ODYD EXCEPT PLANS 37038 & EPP74629

112860A00

SCALE: 1 : 3000	OUR FILE: R11286
DATE: 12 May 2022	DRAWN: KDG

Viktor Malyakin/Malkin Construction Ltd.

McPherson Maddox
Land Surveying
3500 – 30th Street
Vernon, BC V1T 5E8
Telephone: (250) 542-4343

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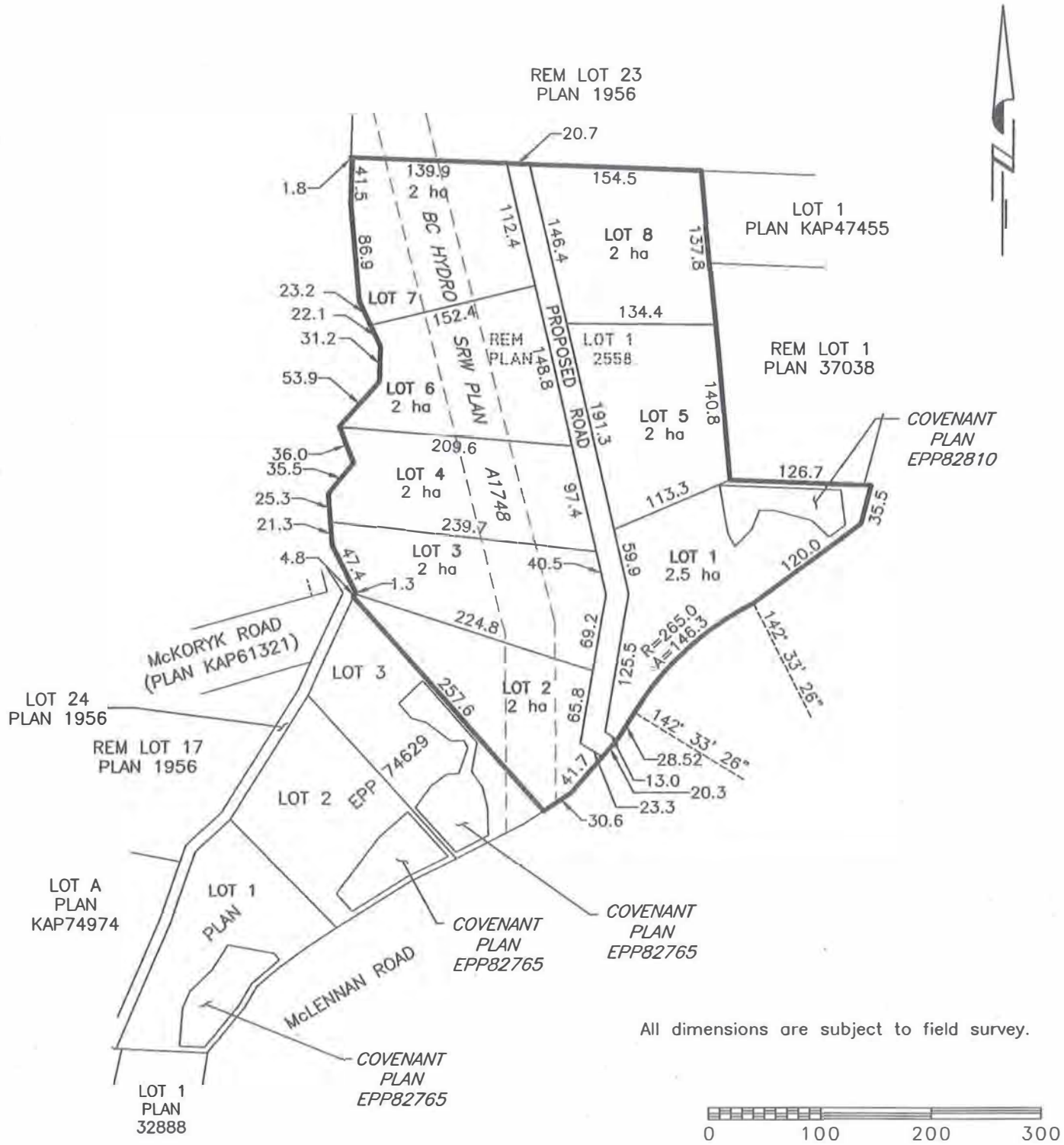
Attachement B – Site Plan showing proposed layout for 8 lots.

ALL DISTANCES ARE IN METRES.



PLAN OF PROPOSED REZONING AND SUBDIVISION OF LOT 1, PLAN 2558, SEC 25, TP 8, ODYD EXCEPT PLANS 37038 & EPP74629

106750A01

SCALE: 1 : 5000	OUR FILE: R10675
DATE: 30 Sep 2019	DRAWN: KG

Dacron Enterprises Ltd

MADDOX & COMPANY
LAND SURVEYORS
3500 – 30th STREET
VERNON, BC V1T 5E8
TELEPHONE: (250) 542-4343

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Attachment C – Drillers Logs for WPID 66090 and WPID 47667.

Groundwater Wells and Aquifers

Well Summary

Well Tag Number: 125513
Well Identification Plate Number: 66090
Owner Name: Viktor Malyakin
Intended Water Use: Private Domestic
Artesian Condition: No

Well Status: New
Well Class: Water Supply
Well Subclass: Not Applicable
Aquifer Number:

Observation Well Number:
Observation Well Status:
Environmental Monitoring System (EMS) ID:
Alternative specs submitted: No

Licensing Information

Licensed Status: Unlicensed

Licence Number:

Location Information

Street Address: 7500 McLennan Rd
Town/City: Vernon

Legal Description:

Lot	
Plan	
District Lot	
Block	
Section	
Township	
Range	
Land District	
Property Identification Description (PID)	

Description of Well Location:

Geographic Coordinates - North American Datum of 1983 (NAD 83)
Latitude: 50.33028 **Longitude:** -119.22389
UTM Easting: 341722 **UTM Northing:** 5577719
Zone: 11 **Coordinate Acquisition Code:** (10 m accuracy) Handheld GPS with accuracy of +/- 10 metres

Well Activity

Activity	Work Start Date	Work End Date	Drilling Company	Date Entered
Construction report	2021-10-15	2021-10-22	Integrity Drilling Inc.	April 4th 2022 at 7:16 PM

Well Work Dates

Start Date of Construction	End Date of Construction	Start Date of Alteration	End Date of Alteration	Start Date of Decommission	End Date of Decommission
2021-10-15	2021-10-22				

Well Completion Data

Total Depth Drilled: 500 ft bgl
Finished Well Depth: 500 ft bgl
Final Casing Stick Up: 29 inches
Depth to Bedrock: 34 feet bgl
Ground elevation: 2099 feet

Estimated Well Yield: 2 USgpm
Well Cap: vermine proof
Well Disinfected Status: Disinfected
Drilling Method: Air Rotary
Method of determining elevation: GPS

Static Water Level (BTOC): 120 feet btoc
Artesian Flow:
Artesian Pressure (head):
Artesian Pressure (PSI):
Orientation of Well: VERTICAL

Lithology

From (ft bgl)	To (ft bgl)	Raw Data	Description	Moisture	Colour	Hardness	Observations	Water Bearing Flow Estimate (USGPM)
0	34	til						
34	35	sasnd/gravel						
35	40	light grey bedrock						
40	77	light brn bedrock						
77	80	dark grey bedriock						
80	100	grey		Damp				
100	200	dark grey						1.2
200	220	dark grey						
220	240	dark grey and white		Wet				
240	300	grey						
300	400	grey and white						
400	500	grey and white						0.8

Casing Details

From (ft bgl)	To (ft bgl)	Casing Type	Casing Material	Diameter (in)	Wall Thickness (in)	Drive Shoe
0	35	Surface casing	Steel	6		Installed

Surface Seal and Backfill Details

Surface Seal Material: Bentonite clay
Surface Seal Installation Method: Poured
Surface Seal Thickness: 1 inches
Surface Seal Depth: 15 feet

Backfill Material Above Surface Seal:
Backfill Depth:

Liner Details

Liner Material: PVC
Liner Diameter: 5 inches
Liner from: 10 (ft bgl)

Liner Thickness:
Liner to: 500 (ft bgl)

Liner perforations

From (ft bgl)	To (ft bgl)
170	175
270	275
370	375
470	475

Screen Details

Intake Method:
Type:
Material:
Opening:
Bottom:

Installed Screens

From (ft bgl)	To (ft bgl)	Diameter (in)	Assembly Type	Slot Size
There are no records to show				

Well Development

Developed by: Air lifting

Development Total Duration: 3 hours

Well Yield

Estimation Method: Air Lifting
Estimation Rate: 2 USgpm
Estimation Duration: 2 hours
Static Water Level Before Test: 120 ft (btoc)
Drawdown: 500 ft (btoc)
Hydrofracturing Performed: Yes
Increase in Yield Due to Hydrofracturing:

Well Decommission Information

Reason for Decommission:
Method of Decommission:
Sealant Material:
Backfill Material:
Decommission Details:

Comments

No comments submitted

Alternative Specs Submitted: Yes

Documents

No additional documentation available for this well.

Disclaimer

BRITISH COLUMBIA
Ministry of Environment

☑ Well Construction Report
☐ Well Closure Report
☐ Well Alteration Report

Dan-Gare Drilling
Stamp: company name/address/ phone/fax/e-mail here, if desired.

Ministry Well ID Plate Number: 47667
Ministry Well Tag Number: 114421
☐ Confirmation/alternative specs. attached
☐ Original well construction report attached

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

Owner name: Daron Enterprises Ltd.
Mailing address: 7566 McLennan Rd. Town Vernon Prov. B.C. Postal Code
Well Location: Address: Street no. 7566 Street name McLennan Rd. Town Vernon
(or) **Legal description:** Lot 4 Plan D.L. Block Sec. Twp. Rg. Land District
(or) **PID:** (and) **Description of well location (attach sketch, if nec.):** Lot 4 of Proposed subdivision of 7566 McLennan Rd.
NAD 83: Zone: 11U (see note 2) (and) **UTM Northing:** 634/434 m **UTM Easting:** 5577576 m (or) **Latitude (see note 3):** **Longitude:**
Method of drilling: ☑ air rotary ☐ cable tool ☐ mud rotary ☐ auger ☐ driving ☐ jetting ☐ excavating ☐ other (specify):
Orientation of well: ☑ vertical ☐ horizontal Ground elevation: 1964 ft (asl) Method (see note 4): GPS
Class of well (see note 5): Water Supply **Sub-class of well:** 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	5		Brown	Clay & Rocks		
5	220		White	Bedrock		
180	220			Bedrock	5	
						Recommended Pump Setting 200

Casing details

From ft (bgl)	To ft (bgl)	Dia in	Casing Material / Open Hole	Wall Thickness in	Drive Shoe
+2	16	6	Steel	.219	Yes

Screen details

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

Surface seal: Type: Bentonite Depth: 16 ft
Method of installation: ☐ Poured ☐ Pumped Thickness: 1 in
Backfill: Type: Depth: ft
Liner: ☐ PVC ☐ Other (specify):
Diameter: 4 in Thickness: .250 in
From: 6 ft (bgl) To: 220 ft (bgl) Perforated: From: 180 ft (bgl) To: 220 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:

Well yield estimated by:

☐ Pumping ☐ Air lifting ☐ Bailing ☐ Other (specify):
Rate: 5 USgpm Duration: hrs
SWL before test: ft (btoc) Pumping water level: ft (btoc)

Obvious water quality characteristics:

☐ Fresh ☐ Salty ☐ Clear ☐ Cloudy ☐ Sediment ☐ Gas
Colour/odour: No Water sample collected: ☑

Well driller (print clearly):

Name (first, last) (see note 19): Logan Flett
Registration no. (see note 20): 08042501
Consultant (if applicable; name and company):

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 Logan Flett

Final well completion data:

Total depth drilled: 220 ft Finished well depth: 220 ft (bgl)
Final stick up: 24 in Depth to bedrock: 5 ft (bgl)
SWL: 76 ft (btoc) Estimated well yield: 5 USgpm
Artesian flow: USgpm, or Artesian pressure: ft
Type of well cap: Aluminum Well disinfected: ☑ Yes ☐ No
Where well ID plate is attached: Stick up

Well closure information:

Reason for closure:
Method of closure: ☐ Poured ☐ Pumped
Sealant material: Backfill material:
Details of closure (see note 17):

Date of work (YYYY/MM/DD):
Started: 2017/05/28 **Completed:** 2017/05/29
Comments:

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

Sheet ____ of ____

Interior Geoscience Inc
Anthony Friesen M.Sc., P.Geo
250-306-4477
tony@interiorgeoscience.com

Attachment D – Laboratory reports

CERTIFICATE OF ANALYSIS

REPORTED TO	Interior Geoscience Inc. 8544 Greenaway Rd. Vernon, BC V1B 3M6		
ATTENTION	Tony Friesen	**WORK ORDER**	22C2535
PO NUMBER		**RECEIVED / TEMP**	2022-03-18 09:06 / 1.8°C
PROJECT	General Potability	**REPORTED**	2022-04-04 10:09
PROJECT INFO		**COC NUMBER**	No Number

Introduction:

CARO Analytical Services is a testing laboratory full of smart, engaged scientists driven to make the world a safer and healthier place. Through our clients' projects we become an essential element for a better world. We employ methods conducted in accordance with recognized professional standards using accepted testing methodologies and quality control efforts. CARO is accredited by the Canadian Association for Laboratories Accreditation (CALA) to ISO/IEC 17025:2017 for specific tests listed in the scope of accreditation approved by CALA.

Big Picture Sidekicks

You know that the sample you collected after snowshoeing to site, digging 5 meters, and racing to get it on a plane so you can submit it to the lab for time sensitive results needed to make important and expensive decisions (whew) is VERY important. We know that too.

We've Got Chemistry

It's simple. We figure the more you enjoy working with our fun and engaged team members; the more likely you are to give us continued opportunities to support you.

Ahead of the Curve

Through research, regulation knowledge, and instrumentation, we are your analytical centre for the technical knowledge you need, BEFORE you need it, so you can stay up to date and in the know.

If you have any questions or concerns, please contact me at teamcaro@caro.ca

Authorized By:

Team CARO
Client Service Representative

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Interior Geoscience Inc.	**WORK ORDER**	22C2535
PROJECT	General Potability	**REPORTED**	2022-04-04 10:09

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
WPID 66090 (22C2535-01) | Matrix: Water | Sampled: 2022-03-17 13:00						
Anions						
Chloride	**11.4**	AO ≤ 250	0.10	mg/L	2022-03-20	
Fluoride	**1.50**	MAC = 1.5	0.10	mg/L	2022-03-20	
Nitrate (as N)	**0.015**	MAC = 10	0.010	mg/L	2022-03-20	
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	2022-03-20	
Sulfate	**235**	AO ≤ 500	1.0	mg/L	2022-03-20	
Calculated Parameters						
Hardness, Total (as CaCO3)	**399**	None Required	0.500	mg/L	N/A	
Langelier Index	< -5.0	N/A	-5.0		2022-03-25	
Solids, Total Dissolved	**610**	AO ≤ 500	10.0	mg/L	N/A	
General Parameters						
Alkalinity, Total (as CaCO3)	**290**	N/A	1.0	mg/L	2022-03-22	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	N/A	1.0	mg/L	2022-03-22	
Alkalinity, Bicarbonate (as CaCO3)	**290**	N/A	1.0	mg/L	2022-03-22	
Alkalinity, Carbonate (as CaCO3)	< 1.0	N/A	1.0	mg/L	2022-03-22	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	N/A	1.0	mg/L	2022-03-22	
Colour, True	**5.4**	AO ≤ 15	5.0	CU	2022-03-21	HT1
Conductivity (EC)	**949**	N/A	2.0	µS/cm	2022-03-22	
Cyanide, Total	< 0.0020	MAC = 0.2	0.0020	mg/L	2022-03-24	
pH	**8.08**	7.0-10.5	0.10	pH units	2022-03-22	HT2
Temperature, at pH	**22.4**	N/A		°C	2022-03-22	HT2
Turbidity	**12.4**	OG < 1	0.10	NTU	2022-03-21	HT1
Microbiological Parameters						
Coliforms, Total	< 1	MAC = 0	1	CFU/100 mL	2022-03-18	
E. coli	< 1	MAC = 0	1	CFU/100 mL	2022-03-18	
Total Metals						
Aluminum, total	**0.0499**	OG < 0.1	0.0050	mg/L	2022-03-23	
Antimony, total	< 0.00020	MAC = 0.006	0.00020	mg/L	2022-03-23	
Arsenic, total	< 0.00050	MAC = 0.01	0.00050	mg/L	2022-03-23	
Barium, total	**0.0260**	MAC = 2	0.0050	mg/L	2022-03-23	
Boron, total	< 0.0500	MAC = 5	0.0500	mg/L	2022-03-23	
Cadmium, total	**0.000015**	MAC = 0.005	0.000010	mg/L	2022-03-23	
Calcium, total	**64.5**	None Required	0.20	mg/L	2022-03-23	
Chromium, total	**0.00111**	MAC = 0.05	0.00050	mg/L	2022-03-23	
Cobalt, total	**0.00043**	N/A	0.00010	mg/L	2022-03-23	
Copper, total	**0.00534**	MAC = 2	0.00040	mg/L	2022-03-23	
Iron, total	**0.293**	AO ≤ 0.3	0.010	mg/L	2022-03-23	
Lead, total	**0.00029**	MAC = 0.005	0.00020	mg/L	2022-03-23	
Magnesium, total	**57.8**	None Required	0.010	mg/L	2022-03-23	
Manganese, total	**0.0279**	MAC = 0.12	0.00020	mg/L	2022-03-23	
Mercury, total	< 0.000010	MAC = 0.001	0.000010	mg/L	2022-03-24	

TEST RESULTS

REPORTED TO	Interior Geoscience Inc.	**WORK ORDER**	22C2535
PROJECT	General Potability	**REPORTED**	2022-04-04 10:09

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
WPID 66090 (22C2535-01) | Matrix: Water | Sampled: 2022-03-17 13:00, Continued						
Total Metals, Continued						
Molybdenum, total	**0.00276**	N/A	0.00010	mg/L	2022-03-23	
Nickel, total	**0.00238**	N/A	0.00040	mg/L	2022-03-23	
Potassium, total	**8.05**	N/A	0.10	mg/L	2022-03-23	
Selenium, total	< 0.00050	MAC = 0.05	0.00050	mg/L	2022-03-23	
Sodium, total	**56.6**	AO ≤ 200	0.10	mg/L	2022-03-23	
Strontium, total	**2.65**	MAC = 7	0.0010	mg/L	2022-03-23	
Uranium, total	**0.000446**	MAC = 0.02	0.000020	mg/L	2022-03-23	
Zinc, total	**0.0336**	AO ≤ 5	0.0040	mg/L	2022-03-23	

Sample Qualifiers:

HT1 The sample was prepared and/or analyzed past the recommended holding time.

HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.

APPENDIX 1: SUPPORTING INFORMATION

REPORTED TO	Interior Geoscience Inc.	**WORK ORDER**	22C2535
PROJECT	General Potability	**REPORTED**	2022-04-04 10:09

Analysis Description	Method Ref.	Technique	Accredited	Location
Alkalinity in Water	SM 2320 B* (2017)	Titration with H2SO4	✓	Kelowna
Anions in Water	SM 4110 B (2017)	Ion Chromatography	✓	Kelowna
Coliforms, Total in Water	SM 9222* (2017)	Membrane Filtration / Chromocult Agar	✓	Kelowna
Colour, True in Water	SM 2120 C (2017)	Spectrophotometry (456 nm)	✓	Kelowna
Conductivity in Water	SM 2510 B (2017)	Conductivity Meter	✓	Kelowna
Cyanide, SAD in Water	ASTM D7511-12	Flow Injection with In-Line UV Digestion and Amperometry	✓	Kelowna
E. coli in Water	SM 9222* (2017)	Membrane Filtration / Chromocult Agar	✓	Kelowna
Hardness in Water	SM 2340 B* (2017)	Calculation: 2.497 [total Ca] + 4.118 [total Mg] (Est)	✓	N/A
Langelier Index in Water	SM 2330 B (2017)	Calculation		N/A
Mercury, total in Water	EPA 245.7*	BrCl2 Oxidation / Cold Vapor Atomic Fluorescence Spectrometry (CVAFS)	✓	Richmond
pH in Water	SM 4500-H+ B (2017)	Electrometry	✓	Kelowna
Solids, Total Dissolved in Water	SM 1030 E (2017)	SM 1030 E (2011)		N/A
Total Metals in Water	EPA 200.2 / EPA 6020B	HNO3+HCl Hot Block Digestion / Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS)	✓	Richmond
Turbidity in Water	SM 2130 B (2017)	Nephelometry	✓	Kelowna

Note: An asterisk in the Method Reference indicates that the CARO method has been modified from the reference method

Glossary of Terms:

RL	Reporting Limit (default)
<	Less than the specified Reporting Limit (RL) - the actual RL may be higher than the default RL due to various factors
°C	Degrees Celcius
AO	Aesthetic Objective
CFU/100 mL	Colony Forming Units per 100 millilitres
CU	Colour Units (referenced against a platinum cobalt standard)
MAC	Maximum Acceptable Concentration (health based)
mg/L	Milligrams per litre
NTU	Nephelometric Turbidity Units
OG	Operational Guideline (treated water)
pH units	pH < 7 = acidic, ph > 7 = basic
µS/cm	Microsiemens per centimetre
ASTM	ASTM International Test Methods
EPA	United States Environmental Protection Agency Test Methods
SM	Standard Methods for the Examination of Water and Wastewater, American Public Health Association

APPENDIX 1: SUPPORTING INFORMATION

REPORTED TO	Interior Geoscience Inc.	**WORK ORDER**	22C2535
PROJECT	General Potability	**REPORTED**	2022-04-04 10:09

General Comments:

The results in this report apply to the samples analyzed in accordance with the Chain of Custody document. This analytical report must be reproduced in its entirety. CARO is not responsible for any loss or damage resulting directly or indirectly from error or omission in the conduct of testing. Liability is limited to the cost of analysis. Samples will be disposed of 30 days after the test report has been issued or once samples expire, whichever comes first. Longer hold is possible if agreed to in writing.

Results in **Bold** indicate values that are above CARO's method reporting limits. Any results that are above regulatory limits are highlighted **red**. Please note that results will only be highlighted red if the regulatory limits are included on the CARO report. Any Bold and/or highlighted results do not take into account method uncertainty. If you would like method uncertainty or regulatory limits to be included on your report, please contact your Account Manager:teamcaro@caro.ca

Please note any regulatory guidelines applied to this report are added as a convenience to the client, at their request, to help provide some initial context to analytical results obtained. Although CARO makes every effort to ensure accuracy of the associated regulatory guideline(s) applied, the guidelines applied cannot be assumed to be correct due to a variety of factors and as such CARO Analytical Services assumes no liability or responsibility for the use of those guidelines to make any decisions. The original source of the regulation should be verified and a review of the guideline (s) should be validated as correct in order to make any decisions arising from the comparison of the analytical data obtained to the relevant regulatory guideline for one's particular circumstances. Further, CARO Analytical Services assumes no liability or responsibility for any loss attributed from the use of these guidelines in any way.

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Interior Geoscience Inc.	**WORK ORDER**	22C2535
PROJECT	General Potability	**REPORTED**	2022-04-04 10:09

The following section displays the quality control (QC) data that is associated with your sample data. Groups of samples are prepared in "batches" and analyzed in conjunction with QC samples that ensure your data is of the highest quality. Common QC types include:

- **Method Blank (Blk)**: A blank sample that undergoes sample processing identical to that carried out for the test samples. Method blank results are used to assess contamination from the laboratory environment and reagents.
- **Duplicate (Dup)**: An additional or second portion of a randomly selected sample in the analytical run carried through the entire analytical process. Duplicates provide a measure of the analytical method's precision (reproducibility).
- **Blank Spike (BS)**: A sample of known concentration which undergoes processing identical to that carried out for test samples, also referred to as a laboratory control sample (LCS). Blank spikes provide a measure of the analytical method's accuracy.
- **Matrix Spike (MS)**: A second aliquot of sample is fortified with a known concentration of target analytes and carried through the entire analytical process. Matrix spikes evaluate potential matrix effects that may affect the analyte recovery.
- **Reference Material (SRM)**: A homogenous material of similar matrix to the samples, certified for the parameter(s) listed. Reference Materials ensure that the analytical process is adequate to achieve acceptable recoveries of the parameter(s) tested.

Each QC type is analyzed at a 5-10% frequency, i.e. one blank/duplicate/spike for every 10-20 samples. For all types of QC, the specified recovery (% Rec) and relative percent difference (RPD) limits are derived from long-term method performance averages and/or prescribed by the reference method.

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Anions, Batch B2C2122										
Blank (B2C2122-BLK1)				Prepared: 2022-03-19, Analyzed: 2022-03-19						
Chloride	< 0.10	0.10	mg/L							
Fluoride	< 0.10	0.10	mg/L							
Nitrate (as N)	< 0.010	0.010	mg/L							
Nitrite (as N)	< 0.010	0.010	mg/L							
Sulfate	< 1.0	1.0	mg/L							
Blank (B2C2122-BLK2)				Prepared: 2022-03-20, Analyzed: 2022-03-20						
Chloride	< 0.10	0.10	mg/L							
Fluoride	< 0.10	0.10	mg/L							
Nitrate (as N)	< 0.010	0.010	mg/L							
Nitrite (as N)	< 0.010	0.010	mg/L							
Sulfate	< 1.0	1.0	mg/L							
LCS (B2C2122-BS1)				Prepared: 2022-03-19, Analyzed: 2022-03-19						
Chloride	15.7	0.10	mg/L	16.0		98	90-110			
Fluoride	4.02	0.10	mg/L	4.00		100	88-108			
Nitrate (as N)	3.86	0.010	mg/L	4.00		97	90-110			
Nitrite (as N)	2.06	0.010	mg/L	2.00		103	85-115			
Sulfate	15.9	1.0	mg/L	16.0		99	90-110			
LCS (B2C2122-BS2)				Prepared: 2022-03-20, Analyzed: 2022-03-20						
Chloride	15.8	0.10	mg/L	16.0		99	90-110			
Fluoride	4.01	0.10	mg/L	4.00		100	88-108			
Nitrate (as N)	3.87	0.010	mg/L	4.00		97	90-110			
Nitrite (as N)	2.02	0.010	mg/L	2.00		101	85-115			
Sulfate	15.9	1.0	mg/L	16.0		100	90-110			
General Parameters, Batch B2C2174										
Blank (B2C2174-BLK1)				Prepared: 2022-03-21, Analyzed: 2022-03-21						
Colour, True	< 5.0	5.0	CU							
Blank (B2C2174-BLK2)				Prepared: 2022-03-21, Analyzed: 2022-03-21						
Colour, True	< 5.0	5.0	CU							

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Interior Geoscience Inc.	**WORK ORDER**	22C2535
PROJECT	General Potability	**REPORTED**	2022-04-04 10:09

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
General Parameters, Batch B2C2174, Continued										
LCS (B2C2174-BS1)				Prepared: 2022-03-21, Analyzed: 2022-03-21						
Colour, True	21	5.0	CU	20.0		107	85-115			
LCS (B2C2174-BS2)				Prepared: 2022-03-21, Analyzed: 2022-03-21						
Colour, True	22	5.0	CU	20.0		111	85-115			
General Parameters, Batch B2C2262										
Blank (B2C2262-BLK1)				Prepared: 2022-03-21, Analyzed: 2022-03-21						
Turbidity	< 0.10	0.10	NTU							
Blank (B2C2262-BLK2)				Prepared: 2022-03-21, Analyzed: 2022-03-21						
Turbidity	< 0.10	0.10	NTU							
LCS (B2C2262-BS1)				Prepared: 2022-03-21, Analyzed: 2022-03-21						
Turbidity	38.6	0.10	NTU	40.0		96	90-110			
LCS (B2C2262-BS2)				Prepared: 2022-03-21, Analyzed: 2022-03-21						
Turbidity	39.7	0.10	NTU	40.0		99	90-110			
General Parameters, Batch B2C2385										
Blank (B2C2385-BLK1)				Prepared: 2022-03-22, Analyzed: 2022-03-22						
Alkalinity, Total (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Bicarbonate (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Carbonate (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Hydroxide (as CaCO3)	< 1.0	1.0	mg/L							
Conductivity (EC)	< 2.0	2.0	µS/cm							
Temperature, at pH	23.2		°C							
Blank (B2C2385-BLK2)				Prepared: 2022-03-22, Analyzed: 2022-03-22						
Alkalinity, Total (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Bicarbonate (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Carbonate (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Hydroxide (as CaCO3)	< 1.0	1.0	mg/L							
Conductivity (EC)	< 2.0	2.0	µS/cm							
Temperature, at pH	24.3		°C							
LCS (B2C2385-BS1)				Prepared: 2022-03-22, Analyzed: 2022-03-22						
Alkalinity, Total (as CaCO3)	107	1.0	mg/L	100		107	80-120			
LCS (B2C2385-BS2)				Prepared: 2022-03-22, Analyzed: 2022-03-22						
Alkalinity, Total (as CaCO3)	107	1.0	mg/L	100		107	80-120			
LCS (B2C2385-BS3)				Prepared: 2022-03-22, Analyzed: 2022-03-22						
Conductivity (EC)	1440	2.0	µS/cm	1410		102	95-105			
LCS (B2C2385-BS4)				Prepared: 2022-03-22, Analyzed: 2022-03-22						
Conductivity (EC)	1460	2.0	µS/cm	1410		103	95-105			
Reference (B2C2385-SRM1)				Prepared: 2022-03-22, Analyzed: 2022-03-22						
pH	7.00	0.10	pH units	7.01		100	98-102			
Reference (B2C2385-SRM2)				Prepared: 2022-03-22, Analyzed: 2022-03-22						
pH	7.00	0.10	pH units	7.01		100	98-102			

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Interior Geoscience Inc.	**WORK ORDER**	22C2535
PROJECT	General Potability	**REPORTED**	2022-04-04 10:09

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
General Parameters, Batch B2C2676										
Blank (B2C2676-BLK1)				Prepared: 2022-03-24, Analyzed: 2022-03-24						
Cyanide, Total	< 0.0020	0.0020	mg/L							
Blank (B2C2676-BLK2)				Prepared: 2022-03-24, Analyzed: 2022-03-24						
Cyanide, Total	< 0.0020	0.0020	mg/L							
LCS (B2C2676-BS1)				Prepared: 2022-03-24, Analyzed: 2022-03-24						
Cyanide, Total	0.0191	0.0020	mg/L	0.0200		96	82-120			
LCS (B2C2676-BS2)				Prepared: 2022-03-24, Analyzed: 2022-03-24						
Cyanide, Total	0.0191	0.0020	mg/L	0.0200		96	82-120			
LCS Dup (B2C2676-BSD1)				Prepared: 2022-03-24, Analyzed: 2022-03-24						
Cyanide, Total	0.0193	0.0020	mg/L	0.0200		97	82-120	1	10	
LCS Dup (B2C2676-BSD2)				Prepared: 2022-03-24, Analyzed: 2022-03-24						
Cyanide, Total	0.0200	0.0020	mg/L	0.0200		100	82-120	5	10	
Microbiological Parameters, Batch B2C2077										
Blank (B2C2077-BLK1)				Prepared: 2022-03-18, Analyzed: 2022-03-18						
Coliforms, Total	< 1	1	CFU/100 mL							
E. coli	< 1	1	CFU/100 mL							
Blank (B2C2077-BLK2)				Prepared: 2022-03-18, Analyzed: 2022-03-18						
Coliforms, Total	< 1	1	CFU/100 mL							
E. coli	< 1	1	CFU/100 mL							
Blank (B2C2077-BLK3)				Prepared: 2022-03-18, Analyzed: 2022-03-18						
Coliforms, Total	< 1	1	CFU/100 mL							
E. coli	< 1	1	CFU/100 mL							
Blank (B2C2077-BLK4)				Prepared: 2022-03-18, Analyzed: 2022-03-18						
Coliforms, Total	< 1	1	CFU/100 mL							
E. coli	< 1	1	CFU/100 mL							
Blank (B2C2077-BLK5)				Prepared: 2022-03-18, Analyzed: 2022-03-18						
Coliforms, Total	< 1	1	CFU/100 mL							
E. coli	< 1	1	CFU/100 mL							
Total Metals, Batch B2C2428										
Blank (B2C2428-BLK1)				Prepared: 2022-03-23, Analyzed: 2022-03-23						
Aluminum, total	< 0.0050	0.0050	mg/L							
Antimony, total	< 0.00020	0.00020	mg/L							
Arsenic, total	< 0.00050	0.00050	mg/L							
Barium, total	< 0.0050	0.0050	mg/L							
Boron, total	< 0.0500	0.0500	mg/L							
Cadmium, total	< 0.000010	0.000010	mg/L							
Calcium, total	< 0.20	0.20	mg/L							
Chromium, total	< 0.00050	0.00050	mg/L							
Cobalt, total	< 0.00010	0.00010	mg/L							
Copper, total	< 0.00040	0.00040	mg/L							
Iron, total	< 0.010	0.010	mg/L							
Lead, total	< 0.00020	0.00020	mg/L							
Magnesium, total	< 0.010	0.010	mg/L							
Manganese, total	< 0.00020	0.00020	mg/L							

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Interior Geoscience Inc.	**WORK ORDER**	22C2535
PROJECT	General Potability	**REPORTED**	2022-04-04 10:09

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Total Metals, Batch B2C2428, Continued										
Blank (B2C2428-BLK1), Continued				Prepared: 2022-03-23, Analyzed: 2022-03-23						
Molybdenum, total	< 0.00010	0.00010	mg/L							
Nickel, total	< 0.00040	0.00040	mg/L							
Potassium, total	< 0.10	0.10	mg/L							
Selenium, total	< 0.00050	0.00050	mg/L							
Sodium, total	< 0.10	0.10	mg/L							
Strontium, total	< 0.0010	0.0010	mg/L							
Uranium, total	< 0.000020	0.000020	mg/L							
Zinc, total	< 0.0040	0.0040	mg/L							
LCS (B2C2428-BS1)				Prepared: 2022-03-23, Analyzed: 2022-03-23						
Aluminum, total	0.0161	0.0050	mg/L	0.0200		81	80-120			
Antimony, total	0.0191	0.00020	mg/L	0.0200		95	80-120			
Arsenic, total	0.0190	0.00050	mg/L	0.0200		95	80-120			
Barium, total	0.0172	0.0050	mg/L	0.0200		86	80-120			
Boron, total	< 0.0500	0.0500	mg/L	0.0200		97	80-120			
Cadmium, total	0.0192	0.000010	mg/L	0.0200		96	80-120			
Calcium, total	1.78	0.20	mg/L	2.00		89	80-120			
Chromium, total	0.0187	0.00050	mg/L	0.0200		94	80-120			
Cobalt, total	0.0188	0.00010	mg/L	0.0200		94	80-120			
Copper, total	0.0213	0.00040	mg/L	0.0200		107	80-120			
Iron, total	2.02	0.010	mg/L	2.00		101	80-120			
Lead, total	0.0200	0.00020	mg/L	0.0200		100	80-120			
Magnesium, total	1.88	0.010	mg/L	2.00		94	80-120			
Manganese, total	0.0184	0.00020	mg/L	0.0200		92	80-120			
Molybdenum, total	0.0206	0.00010	mg/L	0.0200		103	80-120			
Nickel, total	0.0197	0.00040	mg/L	0.0200		99	80-120			
Potassium, total	1.95	0.10	mg/L	2.00		98	80-120			
Selenium, total	0.0194	0.00050	mg/L	0.0200		97	80-120			
Sodium, total	2.01	0.10	mg/L	2.00		100	80-120			
Strontium, total	0.0173	0.0010	mg/L	0.0200		87	80-120			
Uranium, total	0.0189	0.000020	mg/L	0.0200		95	80-120			
Zinc, total	0.0188	0.0040	mg/L	0.0200		94	80-120			
Reference (B2C2428-SRM1)				Prepared: 2022-03-23, Analyzed: 2022-03-23						
Aluminum, total	0.194	0.0050	mg/L	0.198		98	70-130			
Antimony, total	0.0243	0.00020	mg/L	0.0230		106	70-130			
Arsenic, total	0.0214	0.00050	mg/L	0.0200		107	70-130			
Barium, total	0.0147	0.0050	mg/L	0.0161		91	70-130			
Boron, total	0.184	0.0500	mg/L	0.191		97	70-130			
Cadmium, total	0.00412	0.000010	mg/L	0.00404		102	70-130			
Calcium, total	0.94	0.20	mg/L	0.938		100	70-130			
Chromium, total	0.0251	0.00050	mg/L	0.0256		98	70-130			
Cobalt, total	0.0222	0.00010	mg/L	0.0214		104	70-130			
Copper, total	0.0330	0.00040	mg/L	0.0322		102	70-130			
Iron, total	0.064	0.010	mg/L	0.0580		111	70-130			
Lead, total	0.00878	0.00020	mg/L	0.00796		110	70-130			
Magnesium, total	0.108	0.010	mg/L	0.112		97	70-130			
Manganese, total	0.0117	0.00020	mg/L	0.0120		97	70-130			
Molybdenum, total	0.0451	0.00010	mg/L	0.0438		103	70-130			
Nickel, total	0.0415	0.00040	mg/L	0.0394		105	70-130			
Potassium, total	0.87	0.10	mg/L	0.820		106	70-130			
Selenium, total	0.123	0.00050	mg/L	0.117		105	70-130			
Sodium, total	0.53	0.10	mg/L	0.490		108	70-130			
Strontium, total	0.258	0.0010	mg/L	0.276		93	70-130			
Uranium, total	0.00995	0.000020	mg/L	0.00970		103	70-130			
Zinc, total	0.0843	0.0040	mg/L	0.0884		95	70-130			

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Interior Geoscience Inc.	**WORK ORDER**	22C2535
PROJECT	General Potability	**REPORTED**	2022-04-04 10:09

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Total Metals, Batch B2C2643										
Blank (B2C2643-BLK1)				Prepared: 2022-03-23, Analyzed: 2022-03-24						
Mercury, total	< 0.000010	0.000010	mg/L							
Blank (B2C2643-BLK2)				Prepared: 2022-03-23, Analyzed: 2022-03-24						
Mercury, total	< 0.000010	0.000010	mg/L							
Blank (B2C2643-BLK3)				Prepared: 2022-03-23, Analyzed: 2022-03-24						
Mercury, total	< 0.000010	0.000010	mg/L							
Reference (B2C2643-SRM1)				Prepared: 2022-03-23, Analyzed: 2022-03-24						
Mercury, total	0.000268	0.000010	mg/L	0.000250		107	0-200			
Reference (B2C2643-SRM2)				Prepared: 2022-03-23, Analyzed: 2022-03-24						
Mercury, total	0.000260	0.000010	mg/L	0.000250		104	0-200			
Reference (B2C2643-SRM3)				Prepared: 2022-03-23, Analyzed: 2022-03-24						
Mercury, total	0.000265	0.000010	mg/L	0.000250		106	0-200			

CERTIFICATE OF ANALYSIS

REPORTED TO Tony Friesen (Interior Geoscience Inc.)
8544 Greenaway Rd.
Vernon, BC V1B 3M6

SITE INFO
CARO WO# 22K0663

RECEIVED / TEMP 2022-11-04 14:30 / 8.9°C
REPORTED 2022-11-09

Introduction:

CARO Analytical Services is a testing laboratory full of smart, engaged scientists driven to make the world a safer and healthier place. Through our clients' projects we become an essential element for a better world. We employ methods conducted in accordance with recognized professional standards using accepted testing methodologies and quality control efforts. CARO is accredited by the Canadian Association for Laboratories Accreditation (CALA) to ISO/IEC 17025:2017 for specific tests listed in the scope of accreditation approved by CALA.

Big Picture Sidekicks

You know that the sample you collected after snowshoeing to site, digging 5 meters, and racing to get it on a plane so you can submit it to the lab for time sensitive results needed to make important and expensive decisions (whew) is VERY important. We know that too.

We've Got Chemistry

It's simple. We figure the more you enjoy working with our fun and engaged team members; the more likely you are to give us continued opportunities to support you.

Ahead of the Curve

Through research, regulation knowledge, and instrumentation, we are your analytical centre for the technical knowledge you need, BEFORE you need it, so you can stay up to date and in the know.

Report Highlights:

The results in this report apply to the samples analyzed in accordance with your submission. The following parameter(s) exceed the Guidelines for Canadian Drinking Water Quality (Jan 2020):

Sample Name: WIPD 47667

1. Iron, total (AO)
2. Solids, Total Dissolved (AO)
3. Turbidity (OG)

For more information, please visit http://www.caro.ca/reports/

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Laboratory Recommendations:

For assistance reading your report, please visit
https://www.caro.ca/wp-content/uploads/2020/07/How-to-read-your-report-1.pdf
For information about bacteria in water results, please visit
https://www.caro.ca/you-need-to-know-about-bacteria-in-water-analytical-report/
If you have any additional questions or concerns, please contact us at TeamCaro@caro.ca.

Authorized By:

Team CARO
Client Service Representative

TEST RESULTS

REPORTED TO Tony Friesen (Interior Geoscience Inc.)
CARO WO# 22K0663 **REPORTED** 2022-11-09

Parameter	Result	Guideline	RL	Units	Analyzed	Note
Sample Name: WIPD 47667 | Matrix: Water | Sampled: 2022-11-03 21:00						
Anions						
Chloride	**12.2**	AO ≤ 250	0.10	mg/L	2022-11-05	
Fluoride	**1.33**	MAC = 1.5	0.10	mg/L	2022-11-05	
Nitrate (as N)	< 0.010	MAC = 10	0.010	mg/L	2022-11-05	
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	2022-11-05	
Sulfate	**237**	AO ≤ 500	1.0	mg/L	2022-11-05	
Calculated Parameters						
Hardness, Total (as CaCO3)	**411**	None Required	0.500	mg/L	N/A	
Solids, Total Dissolved	**619**	AO ≤ 500	10.0	mg/L	N/A	
General Parameters						
Alkalinity, Total (as CaCO3)	**283**	N/A	1.0	mg/L	2022-11-07	
Conductivity (EC)	**974**	N/A	2.0	µS/cm	2022-11-07	
Cyanide, Total	< 0.0020	MAC = 0.2	0.0020	mg/L	2022-11-08	
pH	**8.15**	7.0-10.5	0.10	pH units	2022-11-07	HT2
Turbidity	**2.61**	OG < 1	0.10	NTU	2022-11-06	
Microbiological Parameters						
Coliforms, Total	< 1	MAC = 0	1	CFU/100 mL	2022-11-04	
E. coli	< 1	MAC = 0	1	CFU/100 mL	2022-11-04	
Total Metals						
Aluminum, total	**0.0065**	OG < 0.1	0.0050	mg/L	2022-11-08	
Antimony, total	< 0.00020	MAC = 0.006	0.00020	mg/L	2022-11-08	
Arsenic, total	< 0.00050	MAC = 0.01	0.00050	mg/L	2022-11-08	
Barium, total	**0.0256**	MAC = 2	0.0050	mg/L	2022-11-08	
Boron, total	< 0.0500	MAC = 5	0.0500	mg/L	2022-11-08	
Cadmium, total	< 0.000010	MAC = 0.005	0.000010	mg/L	2022-11-08	
Calcium, total	**74.2**	None Required	0.20	mg/L	2022-11-08	
Chromium, total	**0.00200**	MAC = 0.05	0.00050	mg/L	2022-11-08	
Copper, total	**0.0116**	MAC = 2	0.00040	mg/L	2022-11-08	
Iron, total	**0.469**	AO ≤ 0.3	0.010	mg/L	2022-11-08	
Lead, total	**0.00057**	MAC = 0.005	0.00020	mg/L	2022-11-08	
Magnesium, total	**54.8**	None Required	0.010	mg/L	2022-11-08	
Manganese, total	**0.0482**	MAC = 0.12	0.00020	mg/L	2022-11-08	
Potassium, total	**9.41**	N/A	0.10	mg/L	2022-11-08	
Selenium, total	< 0.00050	MAC = 0.05	0.00050	mg/L	2022-11-08	
Sodium, total	**59.4**	AO ≤ 200	0.10	mg/L	2022-11-08	
Strontium, total	**1.83**	MAC = 7	0.0010	mg/L	2022-11-08	
Uranium, total	**0.00193**	MAC = 0.02	0.000020	mg/L	2022-11-08	
Zinc, total	**0.0099**	AO ≤ 5	0.0040	mg/L	2022-11-08	

Note Descriptions:

HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.

APPENDIX 1: SUPPORTING INFORMATION

REPORTED TO Tony Friesen (Interior Geoscience Inc.)
CARO WO# 22K0663 **REPORTED** 2022-11-09

Analysis Description	Method Ref.	Technique	Accredited	Location
Alkalinity in Water	SM 2320 B* (2017)	Titration with H2SO4	✓	Kelowna
Anions in Water	SM 4110 B (2017)	Ion Chromatography	✓	Kelowna
Coliforms, Total in Water	SM 9222* (2017)	Membrane Filtration / Chromocult Agar	✓	Kelowna
Conductivity in Water	SM 2510 B (2017)	Conductivity Meter	✓	Kelowna
Cyanide, SAD in Water	ASTM D7511-12	Flow Injection with In-Line UV Digestion and Amperometry	✓	Kelowna
E. coli in Water	SM 9222* (2017)	Membrane Filtration / Chromocult Agar	✓	Kelowna
Hardness in Water	SM 2340 B* (2017)	Calculation: 2.497 [total Ca] + 4.118 [total Mg] (Est)	✓	N/A
pH in Water	SM 4500-H+ B (2017)	Electrometry	✓	Kelowna
Solids, Total Dissolved in Water	SM 1030 E (2017)	SM 1030 E (2011)		N/A
Total Metals in Water	EPA 200.2 / EPA 6020B	HNO3+HCl Hot Block Digestion / Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS)	✓	Richmond
Turbidity in Water	SM 2130 B (2017)	Nephelometry	✓	Kelowna

Note: An asterisk in the Method Reference indicates that the CARO method has been modified from the reference method

Glossary:

RL	Reporting Limit (default)
<	Less than the specified Reporting Limit (RL) - the actual RL may be higher than the default RL due to various factors
AO	Aesthetic Objective
CFU/100 mL	Colony Forming Units per 100 millilitres
MAC	Maximum Acceptable Concentration (health based)
mg/L	Milligrams per litre
NTU	Nephelometric Turbidity Units
OG	Operational Guideline (treated water)
pH units	pH < 7 = acidic, ph > 7 = basic
µS/cm	Microsiemens per centimetre
ASTM	ASTM International Test Methods
EPA	United States Environmental Protection Agency Test Methods
SM	Standard Methods for the Examination of Water and Wastewater, American Public Health Association

APPENDIX 1: SUPPORTING INFORMATION

REPORTED TO Tony Friesen (Interior Geoscience Inc.)
CARO WO# 22K0663 **REPORTED** 2022-11-09

General Comments:

For assistance reading your report, please visit
https://www.caro.ca/wp-content/uploads/2020/07/How-to-read-your-report-1.pdf

For information about bacteria in water results, please visit
https://www.caro.ca/you-need-to-know-about-bacteria-in-water-analytical-report/

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Results in **Bold** indicate values that are above CARO's method reporting limits. Any results that are above regulatory limits are highlighted **red**. Please note that results will only be highlighted red if the regulatory limits are included on the CARO report. Any Bold and/or highlighted results do not take into account method uncertainty. If you would like method uncertainty or regulatory limits to be included on your report, please contact your Account Manager:TeamCaro@caro.ca

Please note any regulatory guidelines applied to this report are added as a convenience to the client, at their request, to help provide some initial context to analytical results obtained. Although CARO makes every effort to ensure accuracy of the associated regulatory guideline(s) applied, the guidelines applied cannot be assumed to be correct due to a variety of factors and as such CARO Analytical Services assumes no liability or responsibility for the use of those guidelines to make any decisions. The original source of the regulation should be verified and a review of the guideline (s) should be validated as correct in order to make any decisions arising from the comparison of the analytical data obtained to the relevant regulatory guideline for one's particular circumstances. Further, CARO Analytical Services assumes no liability or responsibility for any loss attributed from the use of these guidelines in any way.

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO Tony Friesen (Interior Geoscience Inc.)
CARO WO# 22K0663 **REPORTED** 2022-11-09

The following section displays the quality control (QC) data that is associated with your sample data. Groups of samples are prepared in "batches" and analyzed in conjunction with QC samples that ensure your data is of the highest quality. Common QC types include:

- **Method Blank (Blk)**: A blank sample that undergoes sample processing identical to that carried out for the test samples. Method blank results are used to assess contamination from the laboratory environment and reagents.
- **Duplicate (Dup)**: An additional or second portion of a randomly selected sample in the analytical run carried through the entire analytical process. Duplicates provide a measure of the analytical method's precision (reproducibility).
- **Blank Spike (BS)**: A sample of known concentration which undergoes processing identical to that carried out for test samples, also referred to as a laboratory control sample (LCS). Blank spikes provide a measure of the analytical method's accuracy.
- **Matrix Spike (MS)**: A second aliquot of sample is fortified with a known concentration of target analytes and carried through the entire analytical process. Matrix spikes evaluate potential matrix effects that may affect the analyte recovery.
- **Reference Material (SRM)**: A homogenous material of similar matrix to the samples, certified for the parameter(s) listed. Reference Materials ensure that the analytical process is adequate to achieve acceptable recoveries of the parameter(s) tested.

Each QC type is analyzed at a 5-10% frequency, i.e. one blank/duplicate/spike for every 10-20 samples. For all types of QC, the specified recovery (% Rec) and relative percent difference (RPD) limits are derived from long-term method performance averages and/or prescribed by the reference method.

Analyte	Result	MRL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Notes
Anions, Batch B2K0597										
Blank (B2K0597-BLK1)				Prepared: 2022-11-05, Analyzed: 2022-11-05						
Chloride	< 0.10	0.10	mg/L							
Fluoride	< 0.10	0.10	mg/L							
Nitrate (as N)	< 0.010	0.010	mg/L							
Nitrite (as N)	< 0.010	0.010	mg/L							
Sulfate	< 1.0	1.0	mg/L							
LCS (B2K0597-BS1)				Prepared: 2022-11-05, Analyzed: 2022-11-05						
Chloride	15.2	0.10	mg/L	16.0		95	90-110			
Fluoride	4.02	0.10	mg/L	4.00		101	88-108			
Nitrate (as N)	4.05	0.010	mg/L	4.00		101	90-110			
Nitrite (as N)	1.84	0.010	mg/L	2.00		92	85-115			
Sulfate	15.3	1.0	mg/L	16.0		95	90-110			
General Parameters, Batch B2K0743										
Blank (B2K0743-BLK1)				Prepared: 2022-11-06, Analyzed: 2022-11-06						
Turbidity	< 0.10	0.10	NTU							
LCS (B2K0743-BS1)				Prepared: 2022-11-06, Analyzed: 2022-11-06						
Turbidity	43.1	0.10	NTU	40.0		108	90-110			
General Parameters, Batch B2K0844										
Blank (B2K0844-BLK1)				Prepared: 2022-11-07, Analyzed: 2022-11-07						
Alkalinity, Total (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Bicarbonate (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Carbonate (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Hydroxide (as CaCO3)	< 1.0	1.0	mg/L							
Conductivity (EC)	< 2.0	2.0	µS/cm							
Blank (B2K0844-BLK2)				Prepared: 2022-11-07, Analyzed: 2022-11-07						
Alkalinity, Total (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Bicarbonate (as CaCO3)	< 1.0	1.0	mg/L							

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO Tony Friesen (Interior Geoscience Inc.)
CARO WO# 22K0663 **REPORTED** 2022-11-09

Analyte	Result	MRL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Notes
General Parameters, Batch B2K0844, Continued										
Blank (B2K0844-BLK2), Continued				Prepared: 2022-11-07, Analyzed: 2022-11-07						
Alkalinity, Carbonate (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Hydroxide (as CaCO3)	< 1.0	1.0	mg/L							
Conductivity (EC)	< 2.0	2.0	µS/cm							
Blank (B2K0844-BLK3)				Prepared: 2022-11-07, Analyzed: 2022-11-07						
Alkalinity, Total (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Bicarbonate (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Carbonate (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Hydroxide (as CaCO3)	< 1.0	1.0	mg/L							
Conductivity (EC)	< 2.0	2.0	µS/cm							
LCS (B2K0844-BS1)				Prepared: 2022-11-07, Analyzed: 2022-11-07						
Alkalinity, Total (as CaCO3)	96.7	1.0	mg/L	100		97	80-120			
LCS (B2K0844-BS2)				Prepared: 2022-11-07, Analyzed: 2022-11-07						
Alkalinity, Total (as CaCO3)	99.0	1.0	mg/L	100		99	80-120			
LCS (B2K0844-BS3)				Prepared: 2022-11-07, Analyzed: 2022-11-07						
Alkalinity, Total (as CaCO3)	99.8	1.0	mg/L	100		100	80-120			
LCS (B2K0844-BS4)				Prepared: 2022-11-07, Analyzed: 2022-11-07						
Conductivity (EC)	1410	2.0	µS/cm	1410		100	95-105			
LCS (B2K0844-BS6)				Prepared: 2022-11-07, Analyzed: 2022-11-07						
Conductivity (EC)	1410	2.0	µS/cm	1410		100	95-105			
Reference (B2K0844-SRM1)				Prepared: 2022-11-07, Analyzed: 2022-11-07						
pH	7.02	0.10	pH units	7.01		100	98-102			
Reference (B2K0844-SRM2)				Prepared: 2022-11-07, Analyzed: 2022-11-07						
pH	7.01	0.10	pH units	7.01		100	98-102			
Reference (B2K0844-SRM3)				Prepared: 2022-11-07, Analyzed: 2022-11-07						
pH	7.02	0.10	pH units	7.01		100	98-102			
General Parameters, Batch B2K0924										
Blank (B2K0924-BLK1)				Prepared: 2022-11-08, Analyzed: 2022-11-08						
Cyanide, Total	< 0.0020	0.0020	mg/L							
Blank (B2K0924-BLK2)				Prepared: 2022-11-08, Analyzed: 2022-11-08						
Cyanide, Total	< 0.0020	0.0020	mg/L							
LCS (B2K0924-BS1)				Prepared: 2022-11-08, Analyzed: 2022-11-08						
Cyanide, Total	0.0204	0.0020	mg/L	0.0200		102	82-120			
LCS (B2K0924-BS2)				Prepared: 2022-11-08, Analyzed: 2022-11-08						
Cyanide, Total	0.0194	0.0020	mg/L	0.0200		97	82-120			
LCS Dup (B2K0924-BSD1)				Prepared: 2022-11-08, Analyzed: 2022-11-08						
Cyanide, Total	0.0203	0.0020	mg/L	0.0200		102	82-120	< 1	10	
LCS Dup (B2K0924-BSD2)				Prepared: 2022-11-08, Analyzed: 2022-11-08						
Cyanide, Total	0.0203	0.0020	mg/L	0.0200		101	82-120	4	10	
Microbiological Parameters, Batch B2K0570										

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO Tony Friesen (Interior Geoscience Inc.)
CARO WO# 22K0663 **REPORTED** 2022-11-09

Analyte	Result	MRL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Notes
Microbiological Parameters, Batch B2K0570, Continued										
Blank (B2K0570-BLK1)				Prepared: 2022-11-04, Analyzed: 2022-11-04						
Coliforms, Total	< 1	1	CFU/100 mL							
E. coli	< 1	1	CFU/100 mL							
Blank (B2K0570-BLK2)				Prepared: 2022-11-04, Analyzed: 2022-11-04						
Coliforms, Total	< 1	1	CFU/100 mL							
E. coli	< 1	1	CFU/100 mL							
Blank (B2K0570-BLK3)				Prepared: 2022-11-04, Analyzed: 2022-11-04						
Coliforms, Total	< 1	1	CFU/100 mL							
E. coli	< 1	1	CFU/100 mL							
Blank (B2K0570-BLK4)				Prepared: 2022-11-04, Analyzed: 2022-11-04						
Coliforms, Total	< 1	1	CFU/100 mL							
E. coli	< 1	1	CFU/100 mL							
Blank (B2K0570-BLK5)				Prepared: 2022-11-04, Analyzed: 2022-11-04						
Coliforms, Total	< 1	1	CFU/100 mL							
E. coli	< 1	1	CFU/100 mL							
Total Metals, Batch B2K0967										
Blank (B2K0967-BLK1)				Prepared: 2022-11-08, Analyzed: 2022-11-08						
Aluminum, total	< 0.0050	0.0050	mg/L							
Antimony, total	< 0.00020	0.00020	mg/L							
Arsenic, total	< 0.00050	0.00050	mg/L							
Barium, total	< 0.0050	0.0050	mg/L							
Boron, total	< 0.0500	0.0500	mg/L							
Cadmium, total	< 0.000010	0.000010	mg/L							
Calcium, total	< 0.20	0.20	mg/L							
Chromium, total	< 0.00050	0.00050	mg/L							
Copper, total	< 0.00040	0.00040	mg/L							
Iron, total	< 0.010	0.010	mg/L							
Lead, total	< 0.00020	0.00020	mg/L							
Magnesium, total	< 0.010	0.010	mg/L							
Manganese, total	< 0.00020	0.00020	mg/L							
Potassium, total	< 0.10	0.10	mg/L							
Selenium, total	< 0.00050	0.00050	mg/L							
Sodium, total	< 0.10	0.10	mg/L							
Strontium, total	< 0.0010	0.0010	mg/L							
Uranium, total	< 0.000020	0.000020	mg/L							
Zinc, total	< 0.0040	0.0040	mg/L							
LCS (B2K0967-BS1)				Prepared: 2022-11-08, Analyzed: 2022-11-08						
Aluminum, total	3.99	0.0050	mg/L	4.00		100	80-120			
Antimony, total	0.0384	0.00020	mg/L	0.0400		96	80-120			
Arsenic, total	0.0404	0.00050	mg/L	0.0400		101	80-120			
Barium, total	0.0388	0.0050	mg/L	0.0400		97	80-120			
Boron, total	< 0.0500	0.0500	mg/L	0.0400		106	80-120			
Cadmium, total	0.0389	0.000010	mg/L	0.0400		97	80-120			
Calcium, total	4.08	0.20	mg/L	4.00		102	80-120			
Chromium, total	0.0397	0.00050	mg/L	0.0400		99	80-120			
Copper, total	0.0398	0.00040	mg/L	0.0400		99	80-120			
Iron, total	3.97	0.010	mg/L	4.00		99	80-120			
Lead, total	0.0392	0.00020	mg/L	0.0400		98	80-120			
Magnesium, total	3.89	0.010	mg/L	4.00		97	80-120			
Manganese, total	0.0398	0.00020	mg/L	0.0400		99	80-120			

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO Tony Friesen (Interior Geoscience Inc.)
CARO WO# 22K0663 **REPORTED** 2022-11-09

Analyte	Result	MRL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Notes
Total Metals, Batch B2K0967, Continued										
LCS (B2K0967-BS1), Continued				Prepared: 2022-11-08, Analyzed: 2022-11-08						
Potassium, total	4.08	0.10	mg/L	4.00		102	80-120			
Selenium, total	0.0396	0.00050	mg/L	0.0400		99	80-120			
Sodium, total	3.97	0.10	mg/L	4.00		99	80-120			
Strontium, total	0.0398	0.0010	mg/L	0.0400		99	80-120			
Uranium, total	0.0396	0.000020	mg/L	0.0400		99	80-120			
Zinc, total	0.0394	0.0040	mg/L	0.0400		98	80-120			

REGIONAL DISTRICT OF NORTH OKANAGAN

Extract from the Minutes of a Meeting of the

Board of Directors

Held on

Wednesday, December 14, 2022

In-Process Land Use Applications - Keddleston Groundwater Study - Phase 2

Moved and seconded
That further consideration of Zoning Amendment Bylaw No. 2850, 2019 which proposes to change the zoning of the property legally described as Lot 1, Sec 25, Twp 8, ODYD, Plan 2558, Except Plan 37038 and Plan EPP74629 and located at McLennan Road, Electoral Area "C" from Non-Urban (N.U) to Country Residential (C.R) be withheld until the applicant has submitted a hydrogeological report that provides an evaluation of how the proposal aligns with the findings and recommendations of the Keddleston Groundwater Study – Phase 2 and which demonstrates:

1. that groundwater sources would be available to service the full buildout potential of the subject property (8 lots) in accordance with the provisions of Subdivision Servicing Bylaw No. 2600; and
2. that the use of the groundwater supplies would not have a negative impact on the use of existing wells that obtain water from Aquifer 351.

CARRIED

REGIONAL DISTRICT NORTH OKANAGAN

STAFF REPORT

TO:	**Electoral Area Advisory Committee**	**File No:**	**22-0403-C-TA**
FROM:	**Planning Department**	**Date:**	**November 28, 2022**

SUBJECT: In-Process Land Use Applications – Keddleston Groundwater Study - Phase 2

RECOMMENDATION 1:

That further consideration of Electoral Areas "B" and "C" Official Community Plan Amendment Bylaw No. 2771, 2018 and Zoning Amendment Bylaw No. 2772, 2018 which propose to change the Electoral Areas "B" and "C" Official Community Plan land use designation and the zoning of the properties legally described as Lot 2, Plan 2558, Except Plans 32888, KAP49691, KAP78923 & EPP59507; Lot A, Plan EPP59507; and Lot B, Plan EPP45787, Except Plan EPP45973 and located at 7505, 7601, and 7605 McLennan Road, Electoral Area "C" from Non-Urban (N.U) and Country Residential (C.R) to Small Holding (S.H) be withheld until the applicant has submitted a hydrogeological report that provides an evaluation of how the proposal aligns with the findings and recommendations of the Keddleston Groundwater Study – Phase 2 and which demonstrates:

1. that groundwater sources would be available to service the full buildout potential of the subject property (30 lots) in accordance with the provisions of Subdivision Servicing Bylaw No. 2600; and
2. that the use of the groundwater supplies would not have a negative impact on the use of existing wells that obtain water from Aquifer 351.

RECOMMENDATION 2:

That further consideration of Zoning Amendment Bylaw No. 2805, 2018 which proposes to change the zoning of the property legally described as The E 20 Chains of Frac. N 1/2 of SE 1/4, Sec 30, Twp 5, ODYD, Except Plans 19993, 35843 & 36141 and located at 7867 Wilson Jackson Road, Electoral Area "C" from Non-Urban (N.U) to Country Residential (C.R) be withheld until the applicant has submitted a hydrogeological report that provides an evaluation of how the proposal aligns with the findings and recommendations of the Keddleston Groundwater Study – Phase 2 and which demonstrates:

- that groundwater sources would be available to service the full buildout potential of the subject property (4 lots) in accordance with the provisions of Subdivision Servicing Bylaw No. 2600; and
- that the use of the groundwater supplies would not have a negative impact on the use of existing wells that obtain water from Aquifers 349 and 351 and from alluvial deposits along BX Creek.

RECOMMENDATION 3:

That further consideration of Zoning Amendment Bylaw No. 2838, 2019 which proposes to change the zoning of the property legally described as The NE ¼ of the SE ¼ of Sec 20, Twp 5, ODYD and located at Wallace Road, Electoral Area "C" from Non-Urban (N.U) to Country Residential (C.R) be withheld until the applicant has submitted a hydrogeological report that provides an evaluation of how the proposal aligns with the findings and recommendations of the Keddleston Groundwater Study – Phase 2 and which demonstrates:

- that groundwater sources would be available to service the full buildout potential of the subject property (8 lots) in accordance with the provisions of Subdivision Servicing Bylaw No. 2600; and
- that the use of the groundwater supplies would not have a negative impact on the use of existing wells that obtain water from Aquifers 349 and 351.

RECOMMENDATION 4:

That further consideration of Zoning Amendment Bylaw No. 2850, 2019 which proposes to change the zoning of the property legally described as Lot 1, Sec 25, Twp 8, ODYD, Plan 2558, Except Plan 37038 and Plan EPP74629 and located at McLennan Road, Electoral Area "C" from Non-Urban (N.U) to Country Residential (C.R) be withheld until the applicant has submitted a hydrogeological report that provides an evaluation of how the proposal aligns with the findings and recommendations of the Keddleston Groundwater Study – Phase 2 and which demonstrates:

- that groundwater sources would be available to service the full buildout potential of the subject property (8 lots) in accordance with the provisions of Subdivision Servicing Bylaw No. 2600; and
- that the use of the groundwater supplies would not have a negative impact on the use of existing wells that obtain water from Aquifer 351.

RECOMMENDATION 5:

That further consideration of Zoning Amendment Bylaw No. 2903, 2021 which proposes to change the zoning of the property legally described as District Lot 3421, ODYD and located at Forsberg Road, Electoral Area "C" from Large Holding (L.H) to Country Residential (C.R) be withheld until the applicant has submitted a hydrogeological report that provides an evaluation of how the proposal aligns with the findings and recommendations of the Keddleston Groundwater Study – Phase 2 and which demonstrates:

- that groundwater sources would be available to service the full buildout potential of the subject property (30 lots) in accordance with the provisions of Subdivision Servicing Bylaw No. 2600; and
- that the use of the groundwater supplies would not have a negative impact on the use of existing wells that obtain water from Aquifers 349 and 350.

BACKGROUND:

At the Regular Meeting held on July 20, 2022, the Board of Directors endorsed a report from Golder Associates Ltd titled "Keddleston Groundwater Study – Phase 2" and dated June 29, 2022. After considering the report, the Board passed the following resolution:

That staff be directed to bring back a report on the implications of the recommendations contained in the report on in-process land use applications for properties in Electoral Area "C".

There are five in-process land use applications within Electoral Area "C". Staff have made contact with all five applicants. This report provides background information on each application including any water supply information that has been provided by the applicants and has not been previously considered by the Board of Directors. The report also provides recommendations on how to deal with each application with due consideration of the recommendations (see below) contained in the Keddleston Groundwater Study – Phase 2.

KEDDLESTON GROUNDWATER STUDY – PHASE 2:

The objective of the Keddleston Groundwater Study – Phase 2 was to assess the groundwater levels in Aquifer 351, portions of Aquifer 349 and the alluvial deposits along BX Creek and to provide recommendations that would support the Regional District in making informed decisions regarding sustainable development in the study area with respect to groundwater supply.

The Keddleston Groundwater Study – Phase 2 was prepared in follow-up to the Keddleston Groundwater Study prepared by Golder Associates Ltd and dated January 31, 2020. The summary conclusions of the Phase 1 study are that:

- properties within Aquifer 349 have a higher relative potential to supply future development to individual properties and that it is likely that individual wells would not have an impact on neighbouring properties; and
- properties within Aquifers 350 and 351 have limited to no capacity for further development based upon water balance estimates showing that groundwater use is similar or greater than the predicted recharge.

The Keddleston Groundwater Study – Phase 2 report concluded that there is a limited groundwater supply for a number of areas within the study area.

The following summarizes the recommendations in the Keddleston Groundwater Study – Phase 2:

1. Continue the groundwater monitoring program to establish baseline conditions and provide the basis to assess seasonal patterns and long-term trends in water levels. With the data provided from the monitoring program, develop a numerical groundwater flow model to conduct quantitative water budgets and to predict cumulative water level drawdowns in key areas of the aquifer under future development and climate change scenarios. The numerical model would provide a technical basis to support decision-making regarding the sustainability of additional development in different portions of the study area, including the potential implications of developing the additional 350-400 residences that could potentially be developed under current zoning.
2. Strengthen the proof of water supply requirements in the Regional District Subdivision Servicing Bylaw and Building Bylaw to require a more comprehensive assessment of aquifer conditions that demonstrates the availability of a sustainable water supply. The proposed proof of water supply requirements would include the following:
    - At least one year of continuous groundwater level monitoring be conducted and the results analyzed and interpreted by a Qualified Professional;
    - Well pumping tests must be supervised by a Qualified Professional;
    - 48-72 hour pumping tests at the current bylaw rate of 6,550 litres of water per day (1.0 Imperial Gallon per Minute) per parcel, depending on the aquifer type;
    - Water level recovery must be monitored for the same period of time as the pumping test (48-72 hours) and achieve 90 to 95% recovery;
    - At least one observation well must be monitored in the same aquifer and within the same fracture network, during the pumping test and recovery period;
    - Pumping tests are to be conducted in the dry months of the year (August 1st –March 1st);
    - Where an application to the RDNO includes more than one proposed lot, the pumping test must be conducted simultaneously at all wells proposed to service each lot.
3. For existing and future development applications:
    - require a hydrogeological assessment that is signed and stamped by a qualified professional and includes, for each well that is proposed to be used for water supply, analysis and interpretation of at least one year of continuous groundwater level monitoring data and a pumping test that adheres to the proposed changes to the Subdivision Servicing Bylaw and Building Bylaw;
    - consider a phased approach by only approving the number of properties that would support sustainable development with respect to groundwater supply. Further approvals would be contingent upon provision of satisfactory groundwater monitoring data during buildout of the approved number of dwellings.

4. Consider designating Development Permit Areas to control and limit development where groundwater availability issues have been identified. Approval of development permits would be contingent upon specific criteria such as groundwater monitoring and site-specific groundwater protection measures; limiting site disturbance and impervious surfaces; preserving natural soils and vegetation; and low- to no-water use landscaping and alternative water sources.
5. Develop a conservation strategy that advocates for implementation of a household audit program and landscape planning and irrigation initiatives to reduce groundwater demand and encourage the use of alternative water supplies for non-potable uses.

IN-PROCESS LAND USE APPLICATIONS:

1. Electoral Areas "B" and "C" Official Community Plan Amendment Bylaw No. 2771, 2018 and Zoning Amendment Bylaw No. 2772, 2018
File No.: 17-0076-C-OR
Address: 7505, 7601, & 7605 McLennan Road

The above noted application relates to a proposal to change the Electoral Areas "B" and "C" Official Community Plan land use designation and the zoning of the above noted properties from Non-Urban and Country Residential to Small Holding. If successful in rezoning the properties, the applicant proposes to subdivide the properties into 16 lots. Rezoning the properties as proposed would potentially allow for the subdivision of up to 30 lots.

The applicant submitted a report from Western Water Associates Ltd dated September 27, 2017. The report concludes that sufficient groundwater resources would be available at the site to support ±15 lots. The conclusion was based in part on the analysis of data collected from a 68 hour pump test conducted on one well located on the properties and a 72 hour pump test conducted on another well located on the properties.

At the Regular Meeting held on July 17, 2019, the Board considered the application and resolved to refer the associated Official Community Plan Amendment Bylaw No. 2771 and Zoning Amendment Bylaw No. 2772 to a Public Hearing. The Board further resolved that Final Adoption of the Bylaws not be considered until a covenant has been registered on the title of the subject properties, in favour of the Regional District and in priority to all financial charges, that would limit subdivision of the three subject properties to a maximum of 13 new (additional) lots (16 lots in total). The covenant is to contain a clause that would authorize it to be discharged if the Regional District receives a report from a Professional Engineer which states that there is a sufficient groundwater supply to service the full build-out potential of the subject property in accordance with the provisions of the Regional District Subdivision Servicing Bylaw and that the use of groundwater supplies would not have a negative impact on existing wells using the local aquifer.

A Public Hearing was held on August 21, 2019. At the Regular Meeting held on September 18, 2019, the Board gave Third Reading to Bylaw No. 2771 and Bylaw No. 2772. The Board further resolved that an amendment be made to the resolution passed on July 17, 2019 to replace the requirement to register a covenant that would limit subdivision of the subject properties to a maximum of 13 new lots with a requirement to register a covenant that would limit subdivision of the properties until the RDNO undertakes and completes an aquifer assessment that confirms the adequacy of water supply for the level of potential development in the area of Aquifer 351.

At the Regular Meeting held on May 20, 2020, the Board of Directors rescinded Third Reading of Bylaw No. 2771 and Bylaw No. 2772 and resolved to withhold further consideration of the Bylaws until a comprehensive review of the water supply in Aquifer 351 has been completed and the review has

confirmed the adequacy of water supply for the level of potential development in the study area. The Board resolved to forward the Bylaws to a second Public Hearing after the review of the water supply in Aquifer 351 had been completed.

On June 21, 2022, the applicant submitted a letter and report from Western Water Associates Ltd dated June 13, 2022 and October 2021 respectively (available at: https://www.rdno.ca/keddleston). The October 2021 report states:

- As of the date of this report, 18 wells have been drilled on the subject properties, of which 15 wells satisfy RDNO Subdivision Bylaw No. 2600 water quantity requirements for drilled wells providing a source of domestic potable water. All 18 of the wells have driller-estimated yields above the RDNO requirement of 1.2 US gmp. 12 of the 18 wells have driller-estimated yields equal to or greater than the RDNO threshold of 3.6 US gpm which pumping tests are not required. One well did not meet Bylaw requirements when subjected to a 72-hr pumping test, and two wells have lower driller-estimated yields and still require pumping tests to verify adequate yields. 72-hour pumping tests were conducted on 5 of the on-site wells. Water level monitoring was conducted on 11 on-site and off-site wells.
- All of the wells drilled on the site are completed in bedrock Aquifer 351, but it is important to note that the mapped extent of Aquifer 351 does not explicitly take into account underlying geology, which varies across the mapped extent of the aquifer. It is our opinion that differences in the geological setting between the Nodding Hill site and other nearby areas such as the Keddleston Road area result in more favourable conditions for groundwater development in the Nodding Hill area.
- Simulation of collective effects of multiple wells drawing on the aquifer was evaluated by subjecting a centrally located well, WPID 62008, to a variable rate step test and a continuous high volume 72-hour pumping test. The pumping rate used for this test (30 US gpm) was chosen based on the results of the step test, and is equivalent to 25 domestic wells being operated at the RDNO Bylaw requirement at the same time.
- Data collected during the WPID 62008 test suggests that surface water and snowmelt at the site may quickly recharge the underlying aquifer system, as water discharged to ground from this test appears to have quickly returned to the aquifer and raised water levels in wells downslope. The unnamed seasonal stream that transects the site is likely a significant source of aquifer recharge for the area.
- In conclusion, it is our opinion that sufficient groundwater resources exist on the site to support the rezoning application for development to be serviced by private wells without negatively impacting existing wells in the neighbourhood. We recommend a phased approach to development commencing with an initial phase of 10 lots at the north end of the property while groundwater levels in multiple wells onsite continue to be monitored to develop a better understanding of seasonal groundwater fluctuations and aquifer recharge. We recommend that the longer-term monitoring data be reviewed and interpreted and used as the basis for a decision on subsequent future phases of development to the south.

The June 13, 2022 letter states:

- In 2020, we conducted an expanded and more extensive hydrogeological assessment at the property, as reported on in our October 2021 report (WWAL 2021). The work included installation of five water level transducers in wells at the site to monitor groundwater levels, completion of five 72-hour constant rate tests with monitoring of onsite and offsite wells, and water quality sampling. Our 2021 report included water level monitoring data up to September 2021. Since that time, water levels have continued to be monitored.

- Observed recovery during a period of such a significant precipitation deficit demonstrates that Aquifer 351 beneath the Nodding Hill Site is capable of receiving recharge in spite of prolonged drought conditions and is a positive sign as it relates to aquifer recharge and groundwater availability for the proposed project.
- The ongoing water level monitoring at Nodding Hill supports the conclusions of our October 2021 report. Well testing at that time confirmed wells at the property meet the RDNO Subdivision Servicing Bylaw requirements for quantity. Ongoing monitoring demonstrates that the local aquifer receives recharge even during a period of abnormally dry weather (2021) and longer-term below average precipitation. It continues to be our opinion that sufficient groundwater resources exist to support rezoning of the property. We continue to recommend a phased approach to development, beginning with 10 lots in the northern part of the property. A decision to proceed with additional phases of development would be based on the results of continued groundwater level monitoring.

On July 29, 2022, staff sent a letter to the applicant to advise that the Keddleston Groundwater Study – Phase 2 has been presented to the Board of Directors and that the Board has requested a follow-up report as noted above. Staff met with the applicant and asked if he would like to provide any new information about the proposal. In response, the applicant advised that he would like to have the above noted reports considered by the Board of Directors and that in recognition of the recommendations contained in the reports, he is proposing a phased development approach. The applicant has indicated that should the Bylaws be adopted, he would pursue a proposed 17 lot subdivision in phases with an initial 10 lots at the north end of the property. Groundwater levels would continue to be monitored in multiple onsite wells with long-term monitoring data used to inform an assessment of sustainable water usage for future phases of development to the south.

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2. Zoning Amendment Bylaw No. 2805, 2018
File No.: 18-0681-C-RZ
Address: 7867 Wilson Jackson Road

The above noted application relates to a proposal to change the zoning of the above noted property from Non-Urban to Country Residential. If successful in rezoning the property, the applicants propose to subdivide the property into 4 lots. Rezoning the property as proposed would potentially allow for the subdivision of up to 4 lots.

At the Regular Meeting held on November 21, 2018, the Board of Directors considered the application and gave First Reading to the associated Zoning Amendment Bylaw No. 2805. The Board resolved that Second Reading of the Bylaw be withheld until the applicants submitted a water supply study which takes into consideration the potential to service the proposed lots and the impact it could have on the water supply in the area.

In follow-up to the Board's direction, the applicant submitted a report from Watterson Geoscience Inc. dated April 15, 2019 (available at: https://www.rdno.ca/keddleston). The report concludes that sufficient groundwater resources would be available at the site to support 4 lots. The conclusion was based in part on the analysis of data collected from a 24 hour pump test conducted on one well on the property. The report states that:

- Available well and aquifer mapping data, field observations, and the presence of other nearby residences and their wells indicate that sufficient groundwater to meet bylaw volume and flow requirements is likely present beneath the proposed lots from Aquifer 351 llC. It should be noted, however that bedrock water production capability depends on encountering water-bearing fractures, and these fractures may or may not be present at any given drilling location.

- Groundwater may also be present in sand and gravel Aquifer 349 llC. Although not mapped as below the proposed subdivision, it may overlie the bedrock in this area and also serve as a useful groundwater resource.
- Given the distances between the proposed lots and closest wells, it is unlikely that groundwater use at required 1 or 2 IGPM flow rate from the proposed lots will negatively affect groundwater supplies in the area.

On May 8, 2019, the Board gave Second Reading to Bylaw No. 2805 and referred the Bylaw to a Public Hearing. The Board also resolved that Final Adoption of Bylaw No. 2805 be withheld until the applicant has registered a covenant against the title of the subject property which would prohibit subdivision of the property until a professional hydrologist has verified that all wells proposed to service all new lots are proven to meet the quantity and quality standards of the Regional District Subdivision Servicing Bylaw and that the extraction of water from the wells will not negatively impact the water supply of neighbouring wells.

A Public Hearing was held on June 5, 2019. At the Regular Meeting held on June 19, 2019, the Board resolved that further consideration of application be deferred until the feasibility of establishing a community water system in the Keddleston area is considered.

At the Regular Meeting held on May 20, 2020, the Board resolved that further consideration of the application be withheld until a comprehensive review of the water supply in Aquifer 351 has been completed and the review has confirmed the adequacy of water supply for the level of potential development in the study area. The Board further resolved that Bylaw No. 2805 be forwarded to a second Public Hearing after the review of the water supply in Aquifer 351 has been completed.

On July 29, 2022, staff sent a letter to the applicants advising that the Keddleston Groundwater Study – Phase 2 has been presented to the Board of Directors and that the Board has requested a follow-up report as noted above. Staff spoke with the applicants and asked if they would like to provide any new information about the proposal. In response, the applicants advised that they would like to continue with the application as is.

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3. Zoning Amendment Bylaw No. 2838, 2019
File No.: 19-0350-C-RZ
Address: Wallace Road

The above noted application relates to a proposal to change the zoning of the above noted property from Non-Urban to Country Residential. If successful in rezoning the property, the applicant proposes to subdivide the property into 6 lots. Rezoning the property as proposed would potentially allow for the subdivision of up to 8 lots.

The application was presented to the Board of Directors as the Board had previously resolved at the Regular Meeting held on February 19, 2020 that the "current planning and development process be maintained for properties within, and obtaining water from Aquifer 349." This decision was based on the Board's consideration of the Keddleston Groundwater Study prepared by Golder Associates Ltd and dated January 31, 2020 which identified the subject property as being above Aquifer 349 and concluded that "the potential for groundwater development in Aquifer 349 is generally considered to be feasible throughout the aquifer."

At the Regular Meeting held on September 18, 2019, the Board of Directors considered the application and gave First Reading to the associated Zoning Amendment Bylaw No. 2838. The Board resolved that Second Reading of the Bylaw be withheld until the applicant has provided a water study which takes into consideration the potential to service the full build-out potential of the subject property in accordance with the provisions of the Regional District Subdivision Servicing Bylaw and the impact the use of groundwater supplies could have on existing wells in the neighbourhood and the local aquifer.

In follow-up to the Board's direction, the applicant has submitted a report from Associated Engineering Ltd. dated May 2022 (available at: https://www.rdno.ca/keddleston). The report states that a desktop study was completed to assess groundwater availability for the property. The report states:

- Wells in the area source water from either Aquifer 349 or Aquifer 351.
- Average and geometric mean well yield for wells constructed in surficial deposits within 500 m of the site boundary are 99.7 m^3/d and 55.6 m^3/d, respectively, which are significantly higher than the 6.55 m^3/d required under RDNO Subdivision Servicing Bylaw, thus indicating that required well yields would likely be achievable from wells drilled at the site.
- Average and geometric mean well yield for wells constructed in bedrock within 500 m of the site boundary are 116.3 m^3/d and 80.2 m^3/d, respectively, which are significantly higher than the 6.55 m^3/d required under RDNO Subdivision Servicing Bylaw, thus indicating that required well yields would likely be achievable from wells drilled at the site.
- Based on a water demand of 6,550 L/day per lot, the proposed 7-8 lots' water demand would be approximately 1.2-1.8% of the estimated quantity of groundwater flow, as estimated using Darcy's flux calculations for the aquifers found beneath the site.
- The potential density of wells at the site would be similar (or less dense) to the density of existing wells in the area, suggesting that well interference caused by new domestic wells on the site is unlikely to be a problem.
- No drawdown of aquifer levels is indicated in the two observation wells (OBS Wells 311 and 322), suggesting that the use of groundwater at the existing well density is sustainable.
- It is reasonable to assume that there is sufficient groundwater available from either the surficial aquifer or the bedrock aquifer underlying the site to provide domestic use water supplies for 7-8 lots at the site. Based on the well log information for existing wells in the vicinity of the site, the bedrock aquifer appears to be the aquifer that is more likely to provide water supplies to any future properties on the site, although within the site there could be a combination of wells, some constructed in the surficial aquifer and some constructed in bedrock. It is also reasonable to assume, based on the findings of this assessment, that any impacts on neighbouring water supply sources from groundwater use from wells constructed at the site would be negligible.

On July 29, 2022, staff sent a letter to the applicant advising that the Keddleston Groundwater Study – Phase 2 has been presented to the Board of Directors and that the Board has requested a follow-up report as noted above. Staff spoke with the applicant and asked if he would like to provide any new information about the proposal. In response, the applicant advised that he would like to have the above noted report considered by the Board and that he would like to continue with the application as is.

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4. Zoning Amendment Bylaw No. 2850, 2019
File No.: 19-0906-C-RZ
Address: 7500 McLennan Road

The above noted application relates to a proposal to change the zoning of the above noted property from Non-Urban to Country Residential. If successful in rezoning the property, the applicants propose to subdivide the property into 8 lots. Rezoning the property as proposed would potentially allow for the subdivision of up to 8 lots.

At the Regular Meeting held on December 11, 2019, the Board of Directors considered the application and gave First Reading to the associated Zoning Amendment Bylaw No. 2850. The Board resolved that Second Reading of the Bylaw be withheld until the Regional District undertakes and completes the Keddleston Groundwater Study and the study has confirmed the adequacy of water supply for the level of potential development in the study area.

At the Regular Meeting held on May 20, 2020, the Board again considered Bylaw No. 2850 and again resolved that further consideration of the Bylaw be withheld until a comprehensive review of the water supply in Aquifer 351 has been completed and the review has confirmed the adequacy of water supply for the level of potential development in the study area.

In 2021, the property was sold to new owners. On July 29, 2022, staff sent a letter to the new owners to let them know that the Keddleston Groundwater Study – Phase 2 has been presented to the Board of Directors and that the Board has requested a follow-up report as noted above. Staff spoke with the new owner and asked if he would like to provide any new information about the proposal. In response, the applicant advised that he would like to continue with the application as is.

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5. Zoning Amendment Bylaw No. 2903, 2021
File No.: 21-0252-C-RZ
Address: Forsberg Road

The above noted application relates to a proposal to change the zoning of a property located off the south end of Forsberg Road from Large Holding to Country Residential. If successful in rezoning the property, the applicants propose to subdivide the property into 27 lots. Rezoning the property as proposed would potentially allow for the subdivision of up to 30 lots.

The application was presented to the Board of Directors as the Keddleston Groundwater Study prepared by Golder Associates Ltd and dated January 31, 2020 identified the subject property as not being above Aquifers 349, 350 and 351 and the Board had not previously resolved to withhold further consideration of such applications.

At the Regular Meeting held on August 18, 2021, the Board of Directors considered the application and gave First Reading to the associated Zoning Amendment Bylaw No. 2903. The Board resolved that Second Reading of the Bylaw be withheld until the applicant has provided a water study which takes into consideration the potential to service the full build-out potential of the subject property in accordance with the provisions of the Regional District Subdivision Servicing Bylaw and the impact the use of groundwater supplies could have on existing wells in the neighbourhood, any underlying aquifer, and neighbouring downslope aquifers to the west.

In follow-up to the Board's direction, the applicant has submitted reports from Cassiar Geoscience dated August 27, 2021 and March 8, 2022 (available at: https://www.rdno.ca/keddleston). The August 27, 2021 report states the following:

- The findings presented should be considered within the context of the scope of work; further, the findings are time sensitive and considered valid only at the time this report was produced.
- A search of iMapBC indicates that there is no mapped aquifer beneath the subject property, although there are two mapped aquifers adjacent to the west-northwest boundary of the property.
- The northeast boundary of the confined sand and gravel Aquifer 349 is approximate and there is potential this aquifer may extend beneath the subject property. The other aquifer (Bedrock Aquifer 350) may also extend towards the direction of the subject property and may outcrop within the property or the upland area to the east of the property.

- Based on a desktop review of available water well and aquifer data it is inferred that groundwater is likely present beneath the subject property which would be sufficient to service the full build out (up to 30 lots) of the development and have negligible effect on any neighbouring wells.
- It is anticipated that either a bedrock aquifer or an unconsolidated glacial aquifer could be encountered within 300 feet (91 m) of the ground surface.
- It is recommended as the project progresses to subdivision to drill a minimum of one test well to add certainty to the abundance of groundwater within the subject property. A pumping test may be required depending on the lithology encountered and the results from a standard well yield test.

The March 8, 2022 report states that:

- A new well was drilled on the property in the northwest corner. On February 8th, 2022, the drillers conducted a short-term yield test via the air-lifting technique for approximately 1.25 hours. The measured flow rate was 30 gallons per minute (gpm).
- The bedrock in which the well is located has characteristics of a confined aquifer.
- The high potentiometric water level combined with the yield test flow rate of 30 gpm confirm that this well is capable of meeting the subdivision bylaw requirements of the Regional District of North Okanagan. In addition, it is not expected that there will be interference with other domestic water wells as the nearest registered water well is approximately 400 m northwest of Well #1.

On July 29, 2022, staff sent a letter to the applicants advising that the Keddleston Groundwater Study – Phase 2 has been presented to the Board of Directors and that the Board has requested a follow-up report as noted above. Staff spoke with the applicants and asked if they would like to provide any new information about the proposal. The applicants advised that they would like to have the above noted reports considered by the Board and that they would like to continue with the application as is.

DISCUSSION:

1. OCP Amendment Bylaw No. 2771 and Zoning Amendment Bylaw No. 2772 (McLennan Road)

The Planning Department recommends that further consideration of OCP Amendment Bylaw No. 2771 and Zoning Amendment Bylaw No. 2772 be withheld until the applicant has submitted a hydrogeological report which gives due consideration to the findings and recommendations of the Keddleston Groundwater Study – Phase 2 and which demonstrates:

- that groundwater sources would be available to service the full buildout potential of the subject property (30 lots) in accordance with the provisions of Subdivision Servicing Bylaw No. 2600; and
- that the use of the groundwater supplies would not have a negative impact on the use of existing wells that obtain water from Aquifer 351.

The submission of a new hydrogeological report is recommended for the following reasons:

- The subject properties are located just to the east of the west and downgradient side of Aquifer 351 which the Keddleston Groundwater Study – Phase 2 identifies as an area where groundwater supplies "may be limited and will require future proof of water assessments for subdivision or development approvals in this area to characterize the groundwater supply potential sufficiently, and groundwater protection and conservation measures should be considered." While the Keddleston Groundwater Study – Phase 2 does not identify the property as being located in an area of specific concern, it does identify the property as being in an area that requires continued groundwater monitoring and stronger proof of water supply requirements for new developments.
- the hydrogeological reports submitted for the application conclude that sufficient groundwater resources exist on the site to support the rezoning application for development to be serviced by private wells without negatively impacting existing wells in the neighbourhood. However, the report

does not explicitly consider the findings of the Keddleston Groundwater Studies - Phase 2 and while the methodology used to support the findings in the report is very comprehensive, it does not appear to be as comprehensive as the methodology recommended for "existing development applications" in the Keddleston Groundwater Study – Phase 2.

- for existing development applications, the Keddleston Groundwater Study – Phase 2 recommends that for each well proposed to be used as a water supply, an analysis be done of at least one year of continuous groundwater level monitoring data and a pumping test be done that adheres to the proposed changes to the Subdivision Servicing Bylaw and Building Bylaw, including a 48-72 hour pump test on each well proposed to service a lot. Of note, the methodology used to support the findings of the hydrogeological report submitted for the application include the drilling of 18 wells on the subject properties, of which 15 wells satisfy RDNO Subdivision Bylaw requirements. All 18 of the wells have driller-estimated yields above the RDNO requirement of 1.2 US gmp. 12 of the 18 wells have driller-estimated yields equal to or greater than the RDNO threshold of 3.6 US gpm which pumping tests are not required. One well did not meet Bylaw requirements when subjected to a 72-hr pumping test, and two wells have lower driller-estimated yields and still require pumping tests to verify adequate yields. 72-hour pumping tests were conducted on 5 of the on-site wells. Water level monitoring was conducted on 11 on-site and off-site wells.
- Simulation of collective effects of multiple wells drawing on the aquifer was evaluated by subjecting a centrally located well, WPID 62008, to a variable rate step test and a continuous high volume 72-hour pumping test. The pumping rate used for this test (30 US gpm) was chosen based on the results of the step test, and is equivalent to 25 domestic wells being operated at the RDNO Bylaw requirement at the same time.
- the submission of a revised hydrogeological report could compare the methodology outlined in the reports submitted for the application with the methodology recommended in the Keddleston Groundwater Study – Phase 2 and provide an opinion on whether the methodology used in the prior report is a reasonable proxy to the methodology recommended in the latter report.

Should the Board of Directors wish to obtain public comments on the proposal based on the fact that the applicant has submitted a comprehensive hydrogeological report, the Board could recommend that the Bylaws be advanced to a Public Hearing at this stage. Should the Board wish to take this approach, staff recommend that Final Adoption of the Bylaws be withheld until a covenant has been registered on the title of the subject properties to ensure the property is developed in accordance with the recommendations of the hydrogeological reports which recommend a phased approach to development commencing with an initial phase of 10 lots at the north end of the property while groundwater levels in multiple wells onsite continue to be monitored to develop a better understanding of seasonal groundwater fluctuations and aquifer recharge. The longer-term monitoring data would be used as the basis for a decision to amend the covenant to allow future phases of development to the south to proceed.

Alternatively, the Board could resolve to only support rezoning a portion of the properties consistent with the recommendation of the hydrogeological reports. The remainder of the properties could be rezoned once the owner submits a hydrogeological report with water supply data that demonstrates the potential to service the full-build out potential of the properties.

2. Zoning Amendment Bylaw No. 2805 (Wilson Jackson Road)

The Planning Department recommends that further consideration of Zoning Amendment Bylaw No. 2805 be withheld until the applicant has submitted a hydrogeological report which gives due consideration to the findings and recommendations of the Keddleston Groundwater Study – Phase 2 and which demonstrates:

- that groundwater sources would be available to service the full buildout potential of the subject property (4 lots) in accordance with the provisions of Subdivision Servicing Bylaw No. 2600; and
- that the use of the groundwater supplies would not have a negative impact on the use of existing wells that obtain water from Aquifers 349 and 351 and from alluvial deposits along BX Creek.

The submission of a new hydrogeological report is recommended for the following reasons:

- the subject property is located in the Wilson-Jackson / upper Keddleston Road and Clearview Road area which the Keddleston Groundwater Study – Phase 2 identifies as an area "where groundwater availability issues exist and where the groundwater supply potential is inferred to be limited."
- the property is also located in the Wilson-Jackson Road, Jordashe Road and Chew Road area which the Keddleston Groundwater Study – Phase 2 identifies as an area "where groundwater availability is relatively low in the alluvial deposits within the central portion of the Keddleston Area and a sustainable groundwater source may be limited in the area, particularly during drier years."
- the hydrogeological report submitted for the application concludes that sufficient groundwater resources would be available at the site to support 4 lots and that it is unlikely that groundwater use from the proposed lots would negatively affect groundwater supplies in the area. However, the report does not consider the findings of the Keddleston Groundwater Studies (Phases 1 and 2) and the methodology used to support the findings in the report is not as comprehensive as the methodology recommended for "existing development applications" in the Keddleston Groundwater Study – Phase 2.
- for existing development applications, the Keddleston Groundwater Study – Phase 2 recommends that for each well proposed to be used as a water supply, an analysis be done of at least one year of continuous groundwater level monitoring data and a pumping test be done that adheres to the proposed changes to the Subdivision Servicing Bylaw and Building Bylaw, including a 48-72 hour pump test on each well proposed to service a lot. Of note, the methodology used to support the findings of the hydrogeological report submitted for the application did not include groundwater level monitoring or a 48-72 hour pump test. The report analyzed the results of a 24 hour pump test conducted on one well on the property.

3. Zoning Amendment Bylaw No. 2838 (Wallace Road)

The Planning Department recommends that further consideration of Zoning Amendment Bylaw No. 2838 be withheld until the applicant has submitted a hydrogeological report which gives due consideration to the findings and recommendations of the Keddleston Groundwater Study – Phase 2 and which demonstrates:

- that groundwater sources would be available to service the full buildout potential of the subject property (8 lots) in accordance with the provisions of Subdivision Servicing Bylaw No. 2600; and
- that the use of the groundwater supplies would not have a negative impact on the use of existing wells that obtain water from Aquifers 349 and 351.

The submission of a new hydrogeological report is recommended for the following reasons:

- the property is located to the east of the west-central edge of Aquifer 349 which the findings of the Keddleston Groundwater Study – Phase 2 show that "there is variability in the groundwater potential of Aquifer 349, and the potential for a sustainable groundwater supply is limited." While the Keddleston Groundwater Study – Phase 2 does not identify the property as being located in an area of specific concern, it does identify the property as being in an area that requires continued groundwater monitoring and stronger proof of water supply requirements for new developments.

- the hydrogeological report submitted for the application concludes that there is sufficient groundwater available from either Aquifer 349 or 351 to provide domestic use water supplies for 7-8 lots and that any impacts on neighbouring water supply sources from groundwater use from wells constructed at the site would be negligible. However, the report does not consider the findings of the Keddleston Groundwater Studies (Phases 1 and 2) and the methodology used to support the findings in the report is not as comprehensive as the methodology recommended for "existing development applications" in the Keddleston Groundwater Study – Phase 2.
- for existing development applications, the Keddleston Groundwater Study – Phase 2 recommends that for each well proposed to be used as a water supply, an analysis be done of at least one year of continuous groundwater level monitoring data and a pumping test be done that adheres to the proposed changes to the Subdivision Servicing Bylaw and Building Bylaw, including a 48-72 hour pump test on each well proposed to service a lot. Of note, the methodology used to support the findings of the hydrogeological report submitted for the application did not include groundwater level monitoring or the testing of a well on the property.

4. Zoning Amendment Bylaw No. 2850 (McLennan Road)

The Planning Department recommends that further consideration of Zoning Amendment Bylaw No. 2850 be withheld until the applicant has submitted a hydrogeological report which gives due consideration to the findings and recommendations of the Keddleston Groundwater Study – Phase 2 and which demonstrates:

- that groundwater sources would be available to service the full buildout potential of the subject property (8 lots) in accordance with the provisions of Subdivision Servicing Bylaw No. 2600; and
- that the use of the groundwater supplies would not have a negative impact on the use of existing wells that obtain water from Aquifer 351.

The submission of a new hydrogeological report is recommended for the following reasons:

- the subject property is located just to the east of the west and downgradient side of Aquifer 351 which the Keddleston Groundwater Study – Phase 2 identifies as an area where groundwater supplies "may be limited and will require future proof of water assessments for subdivision or development approvals in this area to characterize the groundwater supply potential sufficiently, and groundwater protection and conservation measures should be considered." While the Keddleston Groundwater Study – Phase 2 does not identify the property as being located in an area of specific concern, it does identify the property as being in an area that requires continued groundwater monitoring and stronger proof of water supply requirements for new developments.
- a hydrogeological report has not been submitted for the application. It is noted that the Board resolved that Second Reading of the Bylaw be withheld until the Regional District undertakes and completes the Keddleston Groundwater Study and the study has confirmed the adequacy of water supply for the level of potential development in the study area.

5. Zoning Amendment Bylaw No. 2903 (Forsberg Road)

The Planning Department recommends that further consideration of Zoning Amendment Bylaw No. 2850 be withheld until the applicant has submitted a hydrogeological report which gives due consideration to the findings and recommendations of the Keddleston Groundwater Study – Phase 2 and which demonstrates:

- that groundwater sources would be available to service the full buildout potential of the subject property (30 lots) in accordance with the provisions of Subdivision Servicing Bylaw No. 2600; and
- that the use of the groundwater supplies would not have a negative impact on the use of existing wells that obtain water from Aquifers 349 and 350.

The submission of a new hydrogeological report is recommended for the following reasons:

- the hydrogeological report submitted by the applicant notes that the property may partially overlap Aquifers 349 and 350. The Keddleston Groundwater Study – Phase 2 identified that there is a limited groundwater supply for a portion of Aquifer 349 and the Keddleston Groundwater Study prepared by Golder Associates Ltd and dated January 31, 2020 concludes that properties within Aquifer 350 have limited to no capacity for further development based upon water balance estimates showing that groundwater use is similar or greater than the predicted recharge.
- the hydrogeological report submitted for the application concludes that groundwater is likely present beneath the subject property which would be sufficient to service the full build out of the development and have negligible effect on any neighbouring wells. However, the report does not consider the findings of the Keddleston Groundwater Studies (Phases 1 and 2) and the methodology used to support the findings in the report is not as comprehensive as the methodology recommended for "existing development applications" in the Keddleston Groundwater Study – Phase 2.
- for existing development applications, the Keddleston Groundwater Study – Phase 2 recommends that for each well proposed to be used as a water supply, an analysis be done of at least one year of continuous groundwater level monitoring data and a pumping test be done that adheres to the proposed changes to the Subdivision Servicing Bylaw and Building Bylaw, including a 48-72 hour pump test on each well proposed to service a lot. Of note, the methodology used to support the findings of the hydrogeological report submitted for the application did not include groundwater level monitoring or a 48-72 hour pump test. One well has been drilled on the property and the report notes that the drillers conducted a short-term yield test on the well via the air-lifting technique for approximately 1.25 hours.

Submitted by:

Greg Routley
Deputy Planning Manager

Endorsed By:

Rob Smailes, RPP, MCIP
General Manager, Planning and Building

Approved for inclusion by:

David Sewell
Chief Administrative Officer

REGIONAL DISTRICT OF NORTH OKANAGAN

Extract from the Minutes of a Meeting of the

Board of Directors

Held on

Wednesday, May 20, 2020

Bylaw 2850 - Zoning Amendment (19-0906-C-RZ, Dacron-Bonnough)

Moved and seconded
That further consideration of Zoning Amendment Bylaw No. 2850, 2019 (19-0906-C-RZ, Dacron-Bonnough) which proposes to rezone the property legally described as Lot 1, Sec 25, Twp 8, ODYD, Plan 2558, Except Plan 37038 and Plan EPP74629 and located at McLennan Road, Electoral Area “C”, from the Non-Urban (N.U) Zone to the Country Residential (C.R) Zone be withheld until a comprehensive review of the water supply in Aquifer 351 has been completed as directed by the Board of Directors and the review has confirmed the adequacy of water supply for the level of potential development in the study area.

CARRIED

REGIONAL DISTRICT NORTH OKANAGAN

STAFF REPORT

TO:	**Electoral Area Advisory Committee**	**File No:**	**3063.01**
FROM:	**Planning Department**	**Date:**	**April 8, 2020**

SUBJECT:

- **Electoral Areas "B" and "C" OCP Amendment Bylaw No. 2771 and Zoning Amendment Bylaw No. 2772 (17-0076-C-OR, Nodding Hill);**
- **Zoning Amendment Bylaw No. 2805 (18-0681-C-RZ, Ott); and**
- **Zoning Amendment Bylaw No. 2850 (19-0906-C-RZ, Dacron-Bonnough)**

RECOMMENDATION:

OCP Amendment Bylaw No. 2771 & Zoning Amendment Bylaw No. 2772 [File 17-0076 (Nodding Hill)]

That further consideration of Electoral Areas "B" and "C" Official Community Plan Amendment Bylaw No. 2771, 2018 (17-0076-C-OR, Nodding Hill) which proposes to amend the Electoral Areas "B" and "C" Official Community Plan land use designation of the properties legally described as Lot 2, Plan 2558, Except Plans 32888, KAP49691, KAP78923 & EPP59507; Lot A, Plan EPP59507; and Lot B, Plan EPP45787, Except Plan EPP45973 and located at 7505, 7601, and 7605 McLennan Road, Electoral Area "C" from Country Residential to Small Holding be withheld until a comprehensive review of the water supply in Aquifer 351 has been completed as directed by the Board of Directors and the review has confirmed the adequacy of water supply for the level of potential development in the study area; and further,

That further consideration of Zoning Amendment Bylaw No. 2772, 2018 (17-0076-C-OR, Nodding Hill) which proposes to amend the Regional District of North Okanagan Zoning Bylaw No. 1888, 2003 by changing the zoning of the properties legally described as Lot 2, Plan 2558, Except Plans 32888, KAP49691, KAP78923 & EPP59507; and Lot A, Plan EPP59507 and located at 7505 and 7601 McLennan Road from the Non-Urban (N.U) Zone to the Small Holding (S.H) Zone and by changing the zoning of the property legally described as Lot B, Plan EPP45787, Except Plan EPP45973 and located at 7605 McLennan Road, Electoral Area "C" from the Country Residential (C.R) Zone to the Small Holding (S.H) Zone be withheld until a comprehensive review of the water supply in Aquifer 351 has been completed as directed by the Board of Directors and the review has confirmed the adequacy of water supply for the level of potential development in the study area; and further,

That Third Readings of Electoral Areas "B" and "C" Official Community Plan Amendment Bylaw No. 2771, 2018 (17-0076-C-OR, Nodding Hill) and Zoning Amendment Bylaw No. 2772, 2018 (17-0076-C-OR, Nodding Hill) be rescinded; and further,

That Electoral Areas "B" and "C" Official Community Plan Amendment Bylaw No. 2771, 2018 (17-0076-C-OR, Nodding Hill) and Zoning Amendment Bylaw No. 2772, 2018 (17-0076-C-OR, Nodding Hill) be forwarded to a second Public Hearing after the comprehensive review of the water supply in Aquifer 351 has been completed; and further,

Zoning Amendment Bylaw No. 2805 [File 18-0681-C-RZ (Ott)]

That further consideration of Zoning Amendment Bylaw No. 2805, 2018 (18-0681-C-RZ, Ott) which proposes to rezone the property legally described as The E 20 Chains of Frac. N 1/2 of SE 1/4, Sec 30, Twp 5, ODYD, Except Plans 19993, 35843 & 36141 and located at 7867 Wilson Jackson Road, Electoral Area "C" from the Non-Urban (N.U) Zone to the Country Residential (C.R) Zone be withheld until a comprehensive review of the water supply in Aquifer 351 has been completed as directed by the Board of Directors and the review has confirmed the adequacy of water supply for the level of potential development in the study area; and further,

That Zoning Amendment Bylaw No. 2805, 2018 (18-0681-C-RZ, Ott) be forwarded to a second Public Hearing after the comprehensive review of the water supply in Aquifer 351 has been completed; and further,

Zoning Amendment Bylaw No. 2850, 2019 [File 19-0906-C-RZ (Dacron-Bonnough)]

That further consideration of Zoning Amendment Bylaw No. 2850, 2019 (19-0906-C-RZ, Dacron-Bonnough) which proposes to rezone the property legally described as Lot 1, Sec 25, Twp 8, ODYD, Plan 2558, Except Plan 37038 and Plan EPP74629 and located at McLennan Road, Electoral Area "C", from the Non-Urban (N.U) Zone to the Country Residential (C.R) Zone be withheld until a comprehensive review of the water supply in Aquifer 351 has been completed as directed by the Board of Directors and the review has confirmed the adequacy of water supply for the level of potential development in the study area.

BACKGROUND:

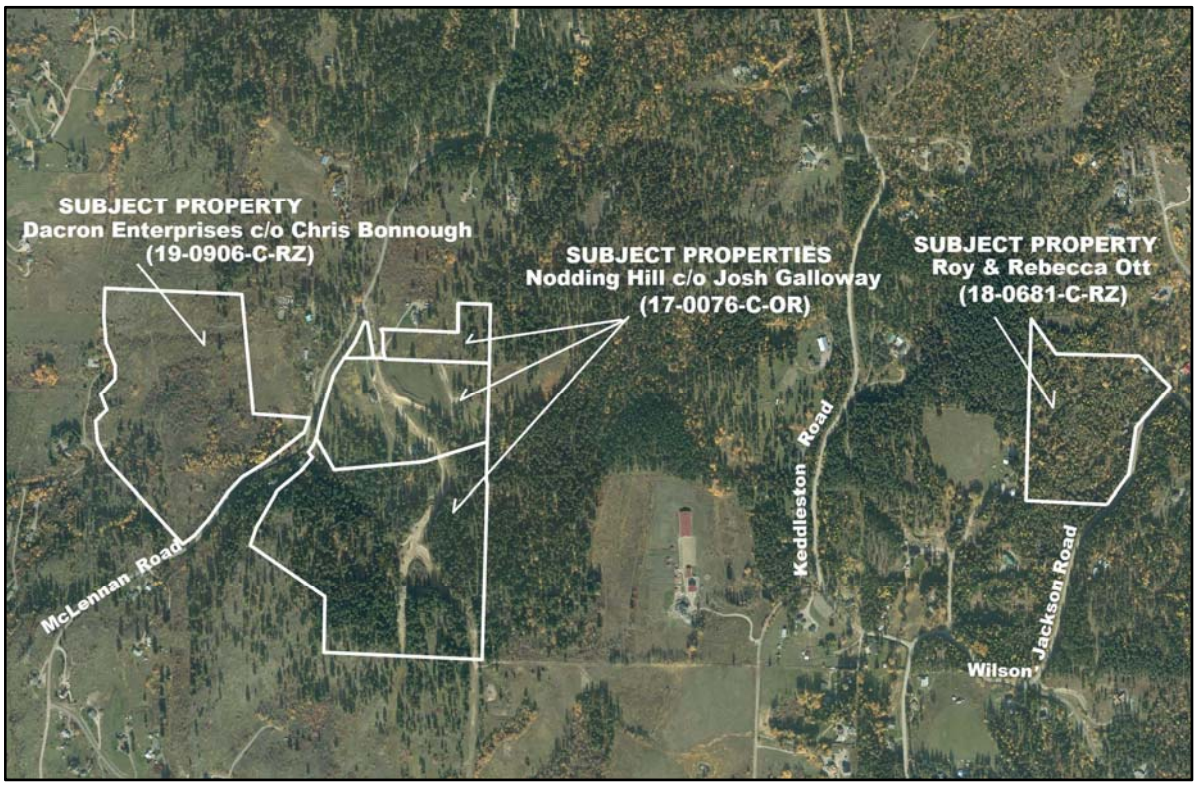
The Keddleston Groundwater Study was prepared by Golder Associates Ltd. and completed on January 31, 2020. The purpose of the groundwater study was to provide the Regional District of North Okanagan (RDNO) with a better understanding of the current groundwater resources in the Keddleston area (specifically, provincially-mapped Aquifers 349, 350, and 351) and the groundwater development potential of the three aquifers to support the RDNO in making informed decisions with regards to sustainable land use development in the Keddleston area reliant on groundwater supplies.

At the Regular Meeting held on February 19, 2020, the Board of Directors resolved, among other things, that further consideration of in-stream Zoning and Official Community Plan amendment applications within Aquifers 350 and 351 be deferred to a special Electoral Area Advisory Committee meeting.

This report has been prepared in follow-up to that resolution. Specifically this report relates to the following three applications which propose to obtain water from the provincially mapped Aquifer 351:

1. Nodding Hill Developments Ltd. c/o Josh Galloway (17-0076-C-OR) - McLennan Road;
2. Roy and Rebecca Ott (18-0681-RZ) - Wilson Jackson Road; and
3. Dacron Enterprises Ltd. c/o Chris Bonnough (19-0906-C-RZ) - McLennan Road.

The following ortho photo (taken in 2018) shows the subject properties associated with the three applications addressed in this report.



Keddleston Groundwater Study

The study area for the Keddleston Groundwater Study covers the provincially-mapped Aquifers 349, 350, and 351. The study indicates that groundwater flow in the area is inferred to be to the west – southwest, from the bedrock dominated upland areas east of the study area towards Swan Lake in the valley bottom.

Aquifer 349 is described as a confined sand and gravel aquifer which covers an area of approximately 25.5 km^2 extending from the east boundary of the study area to the south end of Swan Lake generally following the BX Creek valley. Aquifer 349 overlays the Aquifers 350 and 351. Aquifer 350 is described as a fractured sedimentary rock aquifer covering an area of approximately 7 km^2 extending from the south boundary of the study area and generally along the south side of BX Creek. Aquifer 351 is described as a confined bedrock aquifer which covers an area of approximately 21.8 km^2 extending from the north, west and central boundaries of the study area.

The groundwater study explored "lower-bound" and "upper-bound" estimates of water extraction. Lower-bound estimates were based on an average water use of 0.675 m^3/per person/per day consisting of indoor residential use of 0.15 m^3/day and outdoor residential landscaping use of 0.525 m^3/day/person[1]. Assuming an average of 2.6 persons per household, the lower-bound rate of groundwater extraction, was estimated to be 1.76 m^3/day per household. Upper-bound estimates were based on RDNO's proof of water requirement of 6.55 m^3 per day/per lot (applicable to subdivision in Electoral Areas "B", "C" and "F"). Under the lower-bound estimate, a comparison of groundwater withdrawn from each aquifer relative to the estimated recharge to each aquifer results in a net positive water balance (withdrawal of water is less than recharge of water to the aquifers). Under the upper-bound scenarios, a net negative water balance is obtained for Aquifers 350 and 351 (withdrawal of water is greater than recharge).

[1] 1.0 m^3 of water = 1000 litres = 264 US gallons = 220 Imperial gallons

Based on hydrogeological information and water balance estimates described in the Golder study, it is inferred that within the study area, Aquifer 350 has the least capacity for further development, followed by Aquifer 351, and to a lesser extent, Aquifer 349. The study determined that Aquifer 350 has a high risk with respect to groundwater availability under both the lower-bound and upper-bound estimates. Aquifer 351 has a medium to high risk and Aquifer 349 has a low to medium risk with respect to groundwater availability.

At the Regular Meeting held on February 19, 2020, the Board of Directors considered the Keddleston Groundwater Study along with a staff report prepared by Corporate Services dated January 28, 2020. After considering the reports, the Board passed the following resolution:

> *That the current planning and development process be maintained for properties within, and obtaining water from, Aquifer 349; and further,*
>
> *That the "Keddleston Groundwater Study" by Golder Associates Ltd. be forwarded to the Ministry of Transportation and Infrastructure for consideration in their role as the agency responsible for subdivision approval; and further,*
>
> *That staff be directed to develop a work plan and cost estimate to undertake a comprehensive review of the water supply in Aquifers 350 and 351; and further,*
>
> *That further consideration of in-stream Zoning and Official Community Plan amendment applications within Aquifers 350 or 351 be deferred to a special Electoral Area Advisory Committee meeting; and further,*
>
> *That applications for new Zoning and Official Community Plan amendments that could result in increased density on all properties within, and obtaining water from Aquifers 350 or 351, be considered with the findings of the comprehensive review of water supply in Aquifers 350 and 351.*

Water Supply Standards – Subdivision Servicing Bylaw

The Subdivision Servicing Bylaw requires that, in Electoral Areas "B", "C", and "F", drilled wells that are proposed to supply water for a new lot must produce at least 6,550 L/day. In Electoral Areas "D" and "E", the required well production must be 2,273 L/day. This approach was taken as a result of direction from the Board of Directors who had resolved, at the Regular Meeting held January 6, 2010, that the Subdivision Servicing Bylaw be drafted to reduce the quantity of water required to be proven for groundwater sources in Electoral Areas "D" and "E" to 1/3 Imperial Gallon per Minute which is approximately equivalent to 2,273 L/day.

The Board's decision was based, in part, on information provided by the Okanagan Basin Water Board that indoor residential water use in the Okanagan averaged 150 litres per person per day. Including outdoor water usage such as for pools, lawns and gardens, on average, Okanagan residents used 675 litres of water per person, per day – year round, on their residential properties. In this regard, it was determined that a four person household would use, on average, 2,700 litres of water per day for indoor and outdoor purposes.

The water supply standard established for Electoral Areas "B", "C", and "F" in the Subdivision Servicing Bylaw is intended to ensure an adequate supply of water would be available for households that may be larger than average for reasons of enhanced housing affordability, changing demographics (i.e accommodating aging parents or other extended family members), and households with secondary suites. Based on the above noted averages, the well production standards for Electoral Areas "B", "C", and "F" were considered to be more than adequate to meet the needs of a four-person household.

The well production standards for Electoral Areas "D" and "E" would potentially require property owners to be more conservative with their water usage in order to have sufficient water for all the indoor and outdoor proposes currently enjoyed by the 'average' Okanagan resident.

PLANNING ANALYSIS:

In response to the direction provided by the Board of Directors in the resolution noted above, applications which overlay Aquifer 349 will be advanced individually in accordance with the current planning and development process. There are currently no active applications which propose to use water from Aquifer 350. The Planning Department has prepared this report to address applications which overlay and propose to use water from Aquifer 351. Summary information regarding the three applications is outlined below together with recommendations and options for the consideration of the Electoral Area Advisory Committee and the Board of Directors.

1. Nodding Hill Developments Ltd. c/o Josh Galloway (17-0076-C-OR)

Application Background / Status

This application proposes to change the Official Community Plan (OCP) land use designation of the properties located at 7605, 7601, and 7505 McLennan Road from Country Residential to Small Holding and to rezone the properties from Country Residential (C.R) and Non-Urban (N.U) to Small Holding (S.H). If successful in rezoning the three properties, the applicant is proposing to subdivide them into a total of 16 lots as shown on the attached subdivision plan.

The three subject properties are located to the east of McLennan Road and approximately 580 m to the north of the Foothills neighbourhood which is within the City of Vernon. The properties are designated Country Residential in the Electoral Areas "B" and "C" Official Community Plan, are zoned a combination of Non-Urban (N.U) and Country Residential (C.R) and are not in the ALR.

The applicant proposes that water for the proposed subdivision would be provided by on-site well water sources. In this regard, a hydrogeological groundwater assessment dated September 27, 2017 and prepared by Western Water Associates Ltd. (WWAL) addressed the potential to service the development with individual domestic groundwater wells. This report is available for the Directors to review. As part of their evaluation of the aquifer system beneath the subject properties (Aquifer 351 IIC), WWAL designed and oversaw a test pumping program for two of five wells existing on the subject properties. The tests were conducted between June 19 and July 2 of 2017 when water levels in the aquifer were likely to be near seasonal highs. As noted in the WWAL report, such conditions can lead to optimistic estimates of well yields however WWAL states that changes in seasonal water levels were adequately accounted for in their calculations.

The pumping test results indicated that the two wells have a sustainable yield of 8.4 and 2.4 US gallons per minute (6.9 and 1.9 Imp. gallons per minute). While well interference between wells was noted, WWAL concluded that it was of small magnitude. WWAL explained that the fracturing of bedrock in the area of the subject property appears to have created a productive bedrock aquifer at the site which is apparently more productive than in nearby areas where bedrock is less fractured. WWAL concluded that the potential to develop groundwater supplies for the proposed development is favourable. It was the opinion of WWAL that sufficient groundwater resources are available on the site to support +15 lots without negatively impacting existing wells in the neighbourhood that use the local aquifer.

After considering the application at the Regular Meeting held on September 18, 2019, the Board of Directors gave Third Reading to OCP Amendment Bylaw No. 2771 and Zoning Amendment Bylaw No. 2772. The Board further resolved that an amendment be made to the resolution passed on July 17, 2019 to "replace the requirement to register a covenant that would limit subdivision of the subject properties to a maximum of 13 new lots with a requirement to register a covenant on the title of the

subject properties that would limit subdivision of the properties until the RDNO undertakes and completes an aquifer assessment that confirms the adequacy of water supply for the level of potential development in the area of aquifer 351 outside of the Greater Vernon Water Utility's boundary, at the RDNO's sole discretion."

Recommendation

It is recommended that further consideration of OCP Amendment Bylaw No. 2771 and Zoning Amendment Bylaw No. 2772 be withheld pending completion of a comprehensive review of the water supply in Aquifer 351 as directed by the Board of Directors. Staff acknowledge that the applicant provided a groundwater assessment which concluded that the potential to develop groundwater supplies for the proposed development is favourable. However, the Keddleston Groundwater Study concluded that Aquifer 351 has a medium to high risk with respect to groundwater availability within the study area. Conducting a more comprehensive review would provide more robust information to assist the Board in making decisions related the subject application and the ability to service the proposed development with water from Aquifer 351 including the potential impacts on existing wells.

At such time as the Board of Directors are prepared to give further consideration to Bylaw Nos. 2771 and 2772, either before or after a comprehensive review of the water supply in Aquifer 351 is completed, staff would recommend that a second Public Hearing be held to allow the applicant and members of the public to provide comment to the Board of Directors regarding the proposed Nodding Hill development in consideration of the findings of the Keddleston Water Study, which was received by the Board following the original Public Hearing. Following the close of the Public Hearing, the Board of Directors may:

- adopt Bylaw Nos. 2771 and 2772 subject to the fulfillment of the conditions of adoption; *OR*
- alter and then adopt Bylaw Nos. 2771 and/or 2772 provided that the alteration does not alter the use, increase the density, decrease the density without the owner's consent; *OR*
- defeat Bylaw Nos. 2771 and 2772 and rescind all Readings of the Bylaws; *OR*
- by resolution, provide alternate direction to staff.

Alternate Recommendation

The following Alternate Recommendation is provided should the Board of Directors wish to give further consideration to Bylaw Nos. 2771 and 2772 before a comprehensive review of the water supply in Aquifer 351 is completed:

That Third Reading of Electoral Areas "B" and "C" Official Community Plan Amendment Bylaw No. 2771, 2018 which proposes to amend the Electoral Areas "B" and "C" Official Community Plan land use designation of the properties legally described as Lot 2, Plan 2558, Except Plans 32888, KAP49691, KAP78923 & EPP59507; Lot A, Plan EPP59507; and Lot B, Plan EPP45787, Except Plan EPP45973 and located at 7505, 7601, and 7605 McLennan Road, Electoral Area "C" from Country Residential to Small Holding be rescinded and the Bylaws be forwarded to second Public Hearing; and further,

That Third Reading of Zoning Amendment Bylaw No. 2772, 2018 which proposes to amend the Regional District of North Okanagan Zoning Bylaw No. 1888, 2003 by changing the zoning of the properties legally described as Lot 2, Plan 2558, Except Plans 32888, KAP49691, KAP78923 & EPP59507; and Lot A, Plan EPP59507 and located at 7505 and 7601 McLennan Road from the Non-Urban (N.U) Zone to the Small Holding (S.H) Zone and by changing the zoning of the property legally described as Lot B, Plan EPP45787, Except Plan EPP45973 and located at 7605 McLennan Road, Electoral Area "C" from the Country Residential (C.R) Zone to the Small Holding (S.H) Zone be rescinded and the Bylaws be forwarded to a second Public Hearing.

2. Roy and Rebecca Ott (18-0681-C-RZ)

Application Background / Status

This application proposes to rezone the property located at 7867 Wilson Jackson Road from the Non-Urban (N.U) Zone to the Country Residential (C.R) Zone. If successful in rezoning the property, the applicant is proposing a four (4) lot subdivision as shown on the attached subdivision plan. The subject property is located on the west side of Wilson Jackson Road, is designated Country Residential in the Electoral Areas "B" and "C" Official Community Plan, is zoned Non-Urban (N.U) and is not in the ALR.

The applicant submitted a report prepared by Watterson Geoscience Inc. dated April 15, 2019 which is available for the Directors to review. The report is signed by a hydrogeologist and speaks to the issue of groundwater supply availability and full build-out of the proposed three additional lots. The report states that the following conclusions can be made regarding the excavated well on proposed Lot 1:

- The well capacity flow test results demonstrate that the Lot 1 well can meet the RDNO Bylaw flow requirement of 1 IGPM for 24 hours and produce at least 6,550 liters/day.
- Although the well was tested outside of the dates stipulated in the Bylaw, the well drawdown and recovery rate indicate the water supply, when pumped at the bylaw flow rate, is sustainable.
- Pumping from this well at common residential flow rates should not cause interference with other wells or surface water sources nor affect the underlying aquifer's ability to produce water.
- The water quality samples collected from the well indicates that although the concentration of manganese exceeds Aesthetic Objectives, the water meets all potability requirements. In-home water quality treatment may be desired to address the elevated parameters.

The report further states that following conclusions can be made regarding the groundwater supply potential for proposed Lots 2 - 4:

- Available well and aquifer data, field observations, and the presence of other nearby residences and their wells indicate that sufficient groundwater to meet bylaw volume and flow requirements is likely present beneath the proposed lots from an underlying fractured bedrock Aquifer 351 llC. It should be noted, however that bedrock water production capability depends on encountering water-bearing fractures, and these fractures may or may not be present at any given drilling location.
- Groundwater may also be present in sand and gravel Aquifer 349 llC. Although not mapped as below the proposed subdivision, it may overlie the bedrock in this area and also serve as a useful groundwater resource.
- Given the distances between the proposed lots and closest wells, it is unlikely that groundwater use at required 1 or 2 IGPM flow rate from the proposed lots will negatively affect groundwater supplies in the area.

After considering the application at the Regular Meeting held on May 8, 2019, the Board of Directors gave Second Reading to the associated Zoning Amendment Bylaw No. 2805, and authorized the Bylaw to proceed to a Public Hearing delegated to the Electoral Area Advisory Committee. Further, the Board resolved that Final Adoption of Zoning Amendment Bylaw No. 2805, 2018 be withheld until "the applicant has registered a covenant against the title of the subject property which would prohibit subdivision of the property until a professional hydrologist has verified that all wells proposed to service all new lots are proven to meet the quantity and quality standards of the Regional District of North Okanagan Subdivision Servicing Bylaw No. 2600 and that the extraction of water from the wells will not negatively impact the water supply of neighbouring wells."

The Delegated Public Hearing for Zoning Amendment Bylaw No. 2805 was held on June 5, 2019. The application was again considered by the Board of Directors at its Regular Meeting held on June 19, 2019 at which time the Board resolved that further consideration of Bylaw No. 2805 be deferred until the feasibility of establishing a community water system in the Keddleston area is considered.

Recommendation

It is recommended that further consideration of Zoning Amendment Bylaw No. 2805 be withheld pending completion of a comprehensive review of the water supply in Aquifer 351 as directed by the Board of Directors. Staff acknowledge that the applicant provided a groundwater assessment which concluded that the potential to develop groundwater supplies for the proposed development is favourable. However, the Keddleston Groundwater Study concluded that Aquifer 351 has a medium to high risk with respect to groundwater availability within the study area. Conducting a more comprehensive review would provide more robust information to assist the Board in making decisions related the subject application and the ability to service the proposed development with water from Aquifer 351 including the potential impacts on existing wells.

At such time as the Board of Directors are prepared to give further consideration to Bylaw No. 2805, either before or after a comprehensive review of the water supply in Aquifer 351 is completed, staff would recommend that a second Public Hearing be held to allow the applicant and members of the public to provide comment to the Board of Directors regarding the development proposed by Roy and Rebecca Ott in consideration of the findings of the Keddleston Water Study, which was received by the Board following the original Public Hearing. Following the close of the Public Hearing, the Board of Directors may:

- grant Third Reading and adopt Bylaw No. 2805 subject to the fulfillment of the conditions of adoption; *OR*
- alter Bylaw No. 2805, grant Third Reading then adopt the Bylaw provided that the alteration does not alter the use, increase the density, or decrease the density without the owner's consent; *OR*
- defeat Bylaw No. 2805 and rescind all Readings of the Bylaw; *OR*
- by resolution, provide alternate direction to staff.

Alternate Recommendation

The following Recommendation is provided should the Board wish to give further consideration to Bylaw No. 2805 before a comprehensive review of the water supply in Aquifer 351 is completed:

That Zoning Amendment Bylaw No. 2805, 2018 which proposes to rezone the property legally described as The E 20 Chains of Frac. N 1/2 of SE 1/4, Sec 30, Twp 5, ODYD, Except Plans 19993, 35843 & 36141 and located at 7867 Wilson Jackson Road, Electoral Area "C" from the Non-Urban (N.U) Zone to the Country Residential (C.R) Zone be forwarded to a second Public Hearing.

3. Dacron Enterprises Ltd. c/o Chris Bonnough (19-0906-C-RZ)

Application Background / Status

This application proposes to rezone an approximately 17 ha property located on McLennan Road from the Non-Urban (N.U) zone to the Country Residential (C.R) zone. If successful in rezoning the property, the applicant is proposing an eight (8) lot subdivision as shown on the attached subdivision plan. The subject property is located on the west side of McLennan Road approximately 1 km north of the intersection with L & A Road. The property is designated Country Residential in the Electoral Areas "B" and "C" Official Community Plan, is zoned Non-Urban (N.U), and is not in the ALR.

After considering the application at the Regular Meeting held on December 11, 2019, the Board of Directors gave First Reading to the associated Zoning Amendment Bylaw No. 2850. The Board further resolved that Second Reading of Bylaw No. 2850 be withheld until the Regional District of North Okanagan undertakes and completes the Keddleston Groundwater Study and the study has confirmed the adequacy of water supply for the level of potential development in the study area.

Recommendation

It is recommended that further consideration of Zoning Amendment Bylaw No. 2850 be withheld pending completion of a comprehensive review of the water supply in Aquifer 351 as directed by the Board of Directors. The Keddleston Groundwater Study concluded that Aquifer 351 has a medium to high risk with respect to groundwater availability. Conducting a more comprehensive review would provide more robust information to assist the Board in making decisions related the subject application and the ability to service the proposed development with water from Aquifer 351 including the potential impacts on existing wells.

At such time as the Board of Directors are prepared to give further consideration to Bylaw No. 2850, either before or after a comprehensive review of the water supply in Aquifer 351 is completed, the Board of Directors may:

- give Second Reading to Bylaw No. 2850 and refer the Bylaw to a Public Hearing; *OR*
- defeat Bylaw No. 2850 and rescind First Reading of the Bylaw; *OR*
- by resolution, provide alternate direction to staff.

SUMMARY:

The Keddleston Groundwater Study, prepared by Golder Associates Ltd., was completed at the end of January 2020 and presented to the Board of Directors at their Regular Meeting held on February 19th. In follow-up to the Board's direction, this report has been prepared to address three development applications for which further consideration of the Board of Directors was deferred or withheld pending the completion of the Keddleston Groundwater Study or the registration of a covenant that would limit future subdivision until the RDNO completes an aquifer assessment that confirms the adequacy of water supply for the level of potential development.

The three applications subject of this report would potentially obtain water from provincially mapped Aquifer 351. Staff are of the opinion that two of the three applications will require a second Public Hearing due to the Board's receipt of additional information (Keddleston Groundwater Study). In accordance with the February 19th resolution of the Board, the remaining four applications, which overlay Aquifer 349, will be advanced individually in accordance with the current planning and development process.

Submitted by:

Marnie Skobalski, RPP, MCIP
Planner II

Reviewed by:

Greg Routley
Deputy Planning Manager

Endorsed by:

Rob Smailes, RPP, MCIP
General Manager, Planning and Building

Approved for Inclusion:

David Sewell
Chief Administrative Officer

REGIONAL DISTRICT OF NORTH OKANAGAN

Extract from the Minutes of a Meeting of the

Board of Directors

Held on

Wednesday, December 11, 2019

Bylaw 2850 - Zoning Amendment
DACRON ENTERPRISES LTD. c/o BONNOUGH C., [File No. 19-0906-C-RZ]
McLennan Road, Electoral Area "C"

Moved and seconded
That Zoning Amendment Bylaw No. 2850, 2019 which proposes to rezone the property legally described as Lot 1, Sec 25, Twp 8, ODYD, Plan 2558, Except Plan 37038 and Plan EPP74629 and located at McLennan Road, Electoral Area “C”, from Non-Urban (N.U) to Country Residential (C.R) be given First Reading; and further,

That Second Reading of Zoning Amendment Bylaw No. 2850 be withheld until the Regional District of North Okanagan undertakes and completes the Keddleston Groundwater Study and the study has confirmed the adequacy of water supply for the level of potential development in the study area; and further,

That Final Adoption of Zoning Amendment Bylaw No. 2850, 2019 be withheld until the applicant has made suitable arrangements with the Regional District of North Okanagan to provide an approximate 0.5 m to 1.0 m wide public hiking trail within a 6 m wide Statutory Right of Way that would link McLennan Road through the subject property to the existing Grey Canal Trail.

CARRIED

REGIONAL DISTRICT NORTH OKANAGAN

PLANNING DEPARTMENT INFORMATION REPORT

REZONING APPLICATION

DATE:	November 20, 2019
FILE NO.:	19-0906-C-RZ
OWNER/APPLICANT:	Dacron Enterprises Ltd. c/o Chris Bonnough
LEGAL DESCRIPTION:	Lot 1, Sec 25, Twp 8, ODYD, Plan 2558, Except Plan 37038 and Plan EPP74629
P.I.D.#:	004-701-518
CIVIC ADDRESS:	McLennan Road
PROPERTY SIZE:	17.18 ha (42.45 ac)
SERVICING:	On-site septic sewage disposal and domestic groundwater wells
PRESENT ZONING:	Non-Urban (N.U)
PROPOSED ZONING:	Country Residential (C.R)
O.C.P. DESIGNATION:	Country Residential
PROPOSED USE:	Eight (8) lot subdivision

PLANNING DEPARTMENT RECOMMENDATION:

That Zoning Amendment Bylaw No. 2850, 2019 which proposes to rezone the property legally described as Lot 1, Sec 25, Twp 8, ODYD, Plan 2558, Except Plan 37038 and Plan EPP74629 and located at McLennan Road, Electoral Area "C", from Non-Urban (N.U) to Country Residential (C.R) be given First Reading; and further,

That Second Reading of Zoning Amendment Bylaw No. 2850, 2019 be withheld until the applicant has provided a water study which takes into consideration the potential to service the full build-out potential of the subject property (8 lots) in accordance with the provisions of the Regional District of North Okanagan Subdivision Servicing Bylaw No. 2600, 2013 and the impact the use of groundwater supplies could have on existing wells in the neighbourhood and the local aquifer; and further,

That Final Adoption of Zoning Amendment Bylaw No. 2850, 2019 be withheld until the applicant has made suitable arrangements with the Regional District of North Okanagan to provide an approximate 0.5 m to 1.0 m wide public hiking trail within a 6 m wide Statutory Right of Way that would link McLennan Road through the subject property to the existing Grey Canal Trail.

SUMMARY:

The subject application proposes to rezone an approximately 17 ha property located on McLennan Road from the Non-Urban (N.U) zone to the Country Residential (C.R) zone. If successful in rezoning the property, the applicant is proposing an eight (8) lot subdivision. The Planning Department recommends that the proposal be given favourable consideration as it represents a rural residential land use that is consistent with the OCP land use designation of the subject property and it complies with the relevant Policies of the Electoral Areas "B" and "C" Official Community Plan. Staff also recommend that Second Reading of Zoning Amendment Bylaw No. 2850, 2019 be withheld until the applicant submits a water supply study which takes into consideration the potential to service the full build-out potential of the subject property and the impact such groundwater usage could have on existing wells in the surrounding area and the aquifer.

The applicant has voluntarily offered to provide to the Regional District a 6 m wide statutory right of way for a public pathway that would provide pedestrian access from McLennan Road to the existing Grey Canal Trail which borders the westerly property boundary. Staff have recommended that, prior to consideration of Final Adoption of Zoning Amendment Bylaw No. 2850, arrangements be made between the applicant and the Regional District to define and secure the terms through an appropriate legal mechanism.

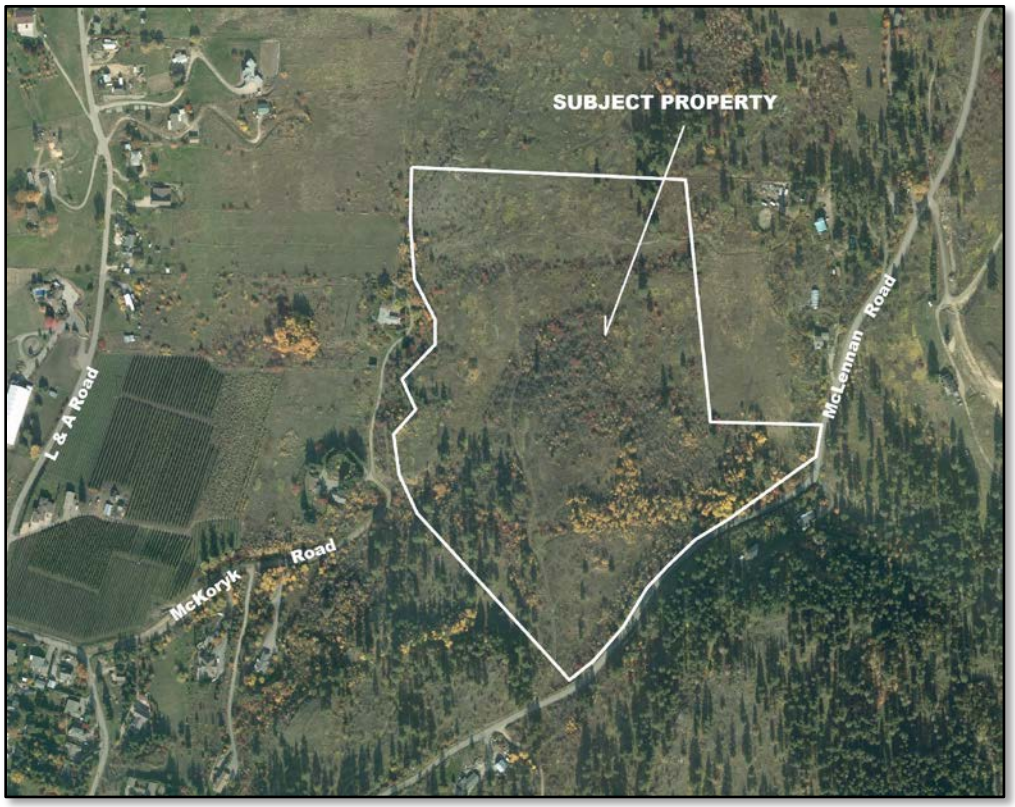
BACKGROUND:

Site Context

The subject property is located on the west side of McLennan Road approximately 1 km north of the intersection with L & A Road. The property is currently undeveloped and therefore has not been assigned a civic address. The property is bordered on the west side by the Grey Canal trail and is traversed from north to south by a BC Hydro right of way. The property is characterized by hillside terrain with intermittent knolls and benches and gentle to steep slopes extending upwards from west to east. The property is partially treed and partially open with areas of native shrubs and grass. RDNO's mapping indicates the potential presence of two streams within the property. An unpaved private driveway provides access to the property from McLennan Road.

The subject property is designated Country Residential in the Electoral Areas "B" and "C" Official Community Plan, is zoned Non-Urban (N.U), and is not in the ALR. As shown on the attached Official Community Plan, Zoning, and ALR maps, the properties to the north, east and south are designated Country Residential. To the west, properties are designated Future Residential and Agricultural. The Agricultural designation corresponds to land within the Agricultural Land Reserve (ALR). Properties to the north and south are zoned Non-Urban (N.U) and Country Residential (C.R) while properties to the east and west are zoned Country Residential (C.R).

The following orthophoto of the subject and surrounding properties was taken in 2018.



Previous Development Applications

A portion of the parent parcel of the subject property was rezoned from Non-Urban (N.U) to Country Residential (C.R) in 2017 to facilitate a three (3) lot subdivision. As a condition of Second Reading of the Zoning Amendment Bylaw, (Bylaw No. 2727), the applicant was required to provide a water supply study which considered the potential to service the proposed subdivision and the impact it could have on the water supply in the area. A hydrogeologist's report was subsequently provided which concluded that sufficient groundwater supplies were likely to be present beneath the three proposed lots and that it was unlikely that groundwater use from the proposed lots would impact water supply of neighbouring wells.

At their January 4, 2017 Regular Meeting, the Board of Directors granted the Zoning Amendment Bylaw Second Reading and further resolved that Final Adoption not be considered until a covenant was registered on the title of the property stating that the property may not be subdivided until a professional hydrologist had verified that all wells proposed to service all new lots are proven to meet the quantity and quality standards of the Regional District's Subdivision Servicing Bylaw and that the extraction of water from the wells would not have a negative impact on the water supply of neighbouring wells. Such a covenant (Covenant No. CA5981869) was registered on the title of the parent parcel of the subject property on May 9, 2017 and Zoning Amendment Bylaw No. 2727 was adopted on June 7, 2017.

An application for subdivision, to create three 2 ha lots plus one remainder lot, was submitted to the Ministry of Transportation and Infrastructure on May 17, 2017. As the area subject of the subdivision included lands with High Conservation Ranking, an Environmentally Sensitive Lands Development Permit was required and covenants, to address protection of environmentally sensitive areas, were registered on the titles of the three new lots and the remainder lot (the subject property). The covenant (No. CA6966325) on the subject property identifies one building site and the balance of the property as a no-build / no-disturb area. In addition, given the presence of watercourses within the subject property, a covenant (No. CA6966331) was registered on the title of the subject property which specifies, in part, that any development within a riparian assessment area is subject to the provincial Riparian Areas Regulation (RAR).

The Proposal

The applicant is proposing to rezone the subject property from the Non-Urban (N.U) zone to the Country Residential (C.R) zone. If successful, the property owner intends to apply to create an eight (8) lot subdivision generally as shown on the attached site plan. The subdivision is proposed to include seven 2.0 ha lots and one 2.5 ha lot with access provided by McLennan Road and a new 20 m wide road to be dedicated at the time of subdivision. The proposed new subdivision road would extend from its intersection with McLennan Road northwards 500+ m to the north property boundary of the subject property.

The applicant has offered to provide a Statutory Right of Way to the Regional District for a public path that would provide a pedestrian link from McLennan Road to the Grey Canal Trail located to the west.

The applicant proposes that water would be provided by individual drilled wells on each proposed lot. No additional information regarding the potential to use groundwater to service the proposed development has been provided at this time. The applicant is also proposing individual on-site sewage disposal systems for each lot.

PLANNING ANALYSIS:

The Planning Department recommends that the proposal be given favourable consideration as it represents a rural residential land use that is consistent with the Electoral Areas “B” and “C” Official Community Plan land use designation of the subject property and complies with OCP Policies as follows:

a) The applicant has submitted a site plan which shows how the property could be developed under the Country Residential (C.R) zone.

b) The proposed lots would contain building sites that would not be subject to flooding, high water table or terrain instability.

c) The proposed lots would not require excessive expenditures for community services such as roads, utility service and school busing, as such services already exist.

d) Subject to confirmation by a Registered On-Site Wastewater Practitioner prior to issuance of any Building Permit for the proposed lots, it is anticipated that the size and topography of the proposed lots would allow for on-site septic sewerage disposal.

e) At the time of subdivision, the applicant will be required to confirm that each new lot would have a building site and driveway access in compliance with the Zoning Bylaw. It is anticipated that the size and topography of the proposed lots would allow the development of driveways and building sites which comply with these requirements.

f) The applicant's offer to provide a Statutory Right of Way for a local trail connection linking McLennan Road to the Grey Canal Trail is supported by Trails policies of the OCP.

g) Prior to final subdivision approval, unless an exemption applies, a Development Permit will be required which assesses the impact of development activities on riparian areas and terrestrial environmentally sensitive areas.

The proposal has been reviewed against OCP Policies that suggest assurance about water supply should be provided with a rezoning application. In this regard, it is recommended that a hydrogeological assessment be provided to demonstrate that a water source would be available for the proposed development based on the Subdivision Servicing Bylaw No. 2600, 2013 standards for a private domestic well and to determine impacts, if any, of groundwater extraction to service the full build-out potential of the property, on existing wells in the neighbourhood and the local aquifer. Based on the ~17 ha size of the property and the 2.0 ha minimum lot size provisions of the Country Residential (C.R) zone, full build-out potential would be 8 lots.

Recognizing concerns with respect to the potential impacts new development may have on groundwater supplies in the BX area, staff have reviewed a Groundwater Resource Potential Assessment prepared by Watterson Geoscience Inc. dated December 1, 2016 which was prepared for a previous rezoning application involving the parent parcel of the subject property. The 2017 rezoning is described above under Previous Development Applications. As noted above, the hydrogeologist's report concluded that sufficient groundwater supplies were likely to be present beneath the three proposed lots and that it was unlikely that groundwater use from the proposed lots would impact water supply of neighbouring wells.

A second hydrogeologist's report was prepared for the same development as a condition of the 2017 subdivision application which followed approval of the rezoning. The subdivision application proposed to create three 2 ha lots plus one remainder lot. The second report, also prepared by Watterson Geoscience Inc., reported on water quality as well as the construction and production capacity of three wells which were drilled to service the three proposed lots. Wells were drilled to a depth of 460 ft, 180 ft, and 160 ft and the driller's logs indicate estimated production rates of 6 US gpm, 5 US gpm, and 9 US gpm respectively. These results satisfy the proof of water quantity requirements of the Subdivision Servicing Bylaw. Water quality tests indicated elevated levels of iron and manganese which would be treatable with standard water treatment methods. Whereas the hydrogeological studies provided favourable results for the three lot subdivision completed in 2018, the studies did not address the remainder lot (the current subject property).

With respect to environmentally sensitive areas, the Official Community Plan identifies the majority of the subject property as having a High Conservation Ranking while the westerly edge of the property is identified as having a Very High Conservation Ranking. Development Permit guidelines suggest that subdivisions should be designed to protect environmentally sensitive areas and wildlife habitat and a report by a Qualified Environmental Professional may be required. The Development Permit process is intended to address protection of riparian and terrestrial environmentally sensitive areas. The property is not designated as a Wildfire Interface Development Permit Area.

With respect to parks and trails, the Official Community Plan includes policies which support the development of local trails to enhance connectivity between existing and future parks and to other trails. With respect to the applicant's proposed subdivision, as each proposed lot would be a minimum of 2 hectares in size, a requirement to dedicate land, or to provide payment in lieu of land, for park purposes would not be triggered by *Local Government Act* Section 510 (provision of park land or payment for parks purposes). The applicant, however, has voluntarily offered to provide a 6 m wide Statutory Right of Way for a public path to provide a pedestrian connection from McLennan Road to the Grey Canal Trail.

ALTERNATE RECOMMENDATION:

In the event that the Board of Directors deems that further consideration should be given to the use of groundwater to service the proposed eight (8) lot subdivision, the following alternate recommendation is provided for the consideration of the Board:

That Zoning Amendment Bylaw No. 2850, 2019 which proposes to rezone the property legally described as Lot 1, Sec 25, Twp 8, ODYD, Plan 2558, Except Plan 37038 and Plan EPP74629 and located at McLennan Road, Electoral Area "C", from Non-Urban (N.U) to Country Residential (C.R) to permit be given First Reading; and

That Second Reading of Zoning Amendment Bylaw No. 2850 be withheld until the RDNO undertakes and completes the Keddleston Groundwater Study and the study has confirmed the adequacy of water supply for the level of potential development in the study area; and further

That Final Adoption of Zoning Amendment Bylaw No. 2850, 2019 be withheld until the applicant has made suitable arrangements with the Regional District of North Okanagan to provide an approximate 0.5 m to 1.0 m wide public hiking trail within a 6 m wide Statutory Right of Way that would link McLennan Road through the subject property to the existing Grey Canal Trail.

ZONING BYLAW:

Permitted Uses and Minimum Lot Area for Subdivision

The property is proposed to be rezoned from the Non-Urban (N.U) zone to the Country Residential (C.R) zone. Uses permitted in the C.R zone include ancillary single family dwellings, bed and breakfast use, boarding house use, community care facilities, home occupation use, limited agricultural use, limited resource use, manufactured homes, public parks and playgrounds, single family dwellings, two family dwellings, veterinary clinics, wineries and cideries, secondary suites, detached suites, and medical marihuana production facilities. The minimum lot size standard of the C.R and N.U zones are 2.0 ha and 7.2 ha respectively.

Number of Dwellings Per Lot

For properties that are not in the ALR, the maximum number of dwellings permitted on 2.0 ha parcels in the C.R zone is one single family dwelling which may contain a secondary suite, or one manufactured home, or one two-family dwelling. One ancillary single family dwelling or one detached suite is also permitted provided it is ancillary to a single family dwelling which does not contain a secondary suite.

Section 310 - Building Site and Driveways

All lots created within the Country Residential (C.R) zone must contain a contiguous area of land 2,000 m^2 or larger in size to serve as a suitable building site. Building sites must be less than 30% natural slope and be accessible from a public highway in accordance with the following private access driveway design standards:

- Commencing at the edge of the finished road surface, private access driveways must be as close to right angles as practicable to the finished road surface for a minimum distance of 6 m, and have a minimum width of 5.5 m for the distance specified above and 4 m minimum width thereafter, and have a maximum slope of 2% from the ditch line for a minimum distance of 10 m and a maximum slope of 15% thereafter.

OFFICIAL COMMUNITY PLAN:

The Electoral Areas "B" and "C" Official Community Plan designates the land use of the subject property as Country Residential. The following OCP Policies are applicable to the application:

Rural Lands Policies

5.1.4 Developers on Rural Lands will be encouraged to consult with the Ministry of Forests Lands and Natural Resource Operations with regard to subdivision design, layout of roads, selection of building sites and the clearing of trees with regard to protection of the proposed development from wildfire hazard.

5.1.5 Because of the importance of water supplies for new development and the uncertainty about water supply for some Rural Lands, assurance about water supply should be provided with a rezoning application or an application to amend this Plan and as appropriate, hydrogeological studies should be undertaken to determine impacts, if any, on existing wells in the neighbourhood and the local aquifer.

5.1.6 Some lands in this Official Community Plan area are designated as *Country Residential*; however, this designation does not ensure that the land would be rezoned as *Country Residential* and the following information and considerations are necessary to guide a review of any rezoning application which may or may not be approved:

a. maps should be submitted showing how the rezoning area can develop into the *Country Residential* standard including the location of any new streets, environmental protection measures, lot layouts and any community amenities;

b. the area should not be subject to flooding, high water table or terrain instability;

c. the development of the area should not require excessive expenditures for community services such as roads, utility services and school busing;

d. the terrain should be suitable for development whereby each new lot would have a building site and driveway access in compliance with the *"Zoning Bylaw"*;

e. each new lot shall have an area that is adequate for on-site sewage disposal with a reserve site for on-site sewage;

f. information should be provided to show how development can be supplied with an adequate water supply as outlined in Policy 5.1.5 of this Plan;

g. sensitive environmental attributes should not be negatively impacted by a higher density of land use and in this regard, the Regional District may request that an environmental impact analysis be undertaken;

h. other submissions other than those cited herein may be necessary in order to adequately evaluate an application; and

i. notwithstanding these specific considerations, the Regional District will be guided by community goals and objectives cited in this Plan and other policies in this Plan as may be appropriate in the consideration of any application.

Natural Area Policies

11.2.1 Land within the Environmentally Sensitive Land, Development Permit Areas as designated on Schedule 'C' shall not be altered or developed, or subdivision approval granted, unless a Development Permit is issued in accordance with the guidelines in this plan.

11.2.3 All development within the Regional District shall be undertaken in compliance with the provincial *Riparian Areas Regulation*.

11.2.6 Encourage the voluntary protection of natural features.

11.2.7 Encourage the protection, preservation, enhancement and management of sensitive ecosystems or land contiguous to sensitive ecosystems of private lands through the following methods:

a. Donation of areas to the Regional District or provincial government;

b. Donation of areas to a Land Trust or conservation organization;

c. Creation of conservation covenants in favour of municipal, provincial government, private conservation organizations;

d. Establishment of statutory right of ways under the *Land Title Act* for affected areas;

e. Establishment of long-term leases for sensitive areas;

f. Land stewardship and participation in conservation initiatives by the private landowner;

g. Consideration of alternative development standards, such as clustering.

Trails Policies

12.1.12 The Regional District recognizes the need to develop local trails within Electoral Areas "B" & "C" to enhance the connectivity between Sub-Regional trails, any future Sub-Regional parks and local park space. Relevant trails are outlined in the Ribbons of Green Trails Plan 2013-2033 (Schedule G) with the exception of a trail linkage which should be considered between the Foothills Neighbourhood and Cools Pond.

12.1.13 The Regional District recognizes the need to develop priorities and an implementation strategy for the acquisition and development of new trails in the Electoral Areas; however, it is also recognized that when opportunities arise for the acquisition of a new trail segment as identified in the "Ribbons of Green Trail Plan 2013-2033" then prompt action is often necessary despite the priorities in the implementation strategy.

Transportation Policies

15.1.5 Where the Regional District is involved in planning for future roads and subdivisions or plans for improvements to existing roads, consideration will be given to the needs of public transit, school buses, pedestrian walkways and bicycle routes.

15.1.7 The Regional District requests the Ministry of Transportation and Infrastructure (MoTI) approving officer consider the needs of pedestrians and cyclists when approving subdivisions, the creation of new roads or upgrading existing roads. New road designs should accommodate for alternative transportation options with the addition of wider shoulders for pedestrian travel or a wider paved travel surface that can become a designated bicycle route.

15.1.8 The Regional District requests the Ministry of Transportation and Infrastructure approving officer participate in the acquisition and or dedication of linear trail corridors as outlined in Schedule G of this plan during subdivision approvals and or the creation of new roads and upgrading of existing roads.

Environmentally Sensitive Lands Development Permit Area

The subject property will require an Environmentally Sensitive Lands Development Permit at the time of subdivision as the property falls within areas of High and Very High Conservation Ranking as identified on map Schedule 'C' of the Official Community Plan. The primary objective of the Environmentally Sensitive Lands Development Permit Area designation is to regulate development activities in areas of High and Very High conservation value to protect rare and fragile terrestrial ecosystems and habitat for endangered species or native rare vegetation or wildlife.

Riparian and Swan Lake Development Permit Area

The Regional District considers that all watercourses are within the Riparian and Swan Lake Development Permit Area. Given the presence of watercourses within the subject property, a Riparian and Swan Lake Development Permit will be required at the time of subdivision unless an exemption applies. The primary objective of the Riparian and Swan Lake Development Permit designation is to regulate development activities in watercourses and their riparian areas in order to preserve natural features, functions and conditions that support natural processes.

ELECTORAL AREAS 'B' AND 'C' PARKS MASTER PLAN:

At the July 17, 2019 Regular Meeting of the Board of Directors, the Board resolved to endorse the Electoral Areas B and C Parks Master Plan and further that staff be directed to prepare an amendment to the Electoral Areas "B" and "C" Official Community Plan. The Parks Master Plan shows a "Proposed Local Trail" along McLennan Road adjacent to the subject property. The Plan states:

> *There are 50 km of trails proposed along existing roads within Electoral Areas B and C (see Figure 3.2). If constructed, these trails will provide connections to existing sub-regional trails and additional opportunities for safe cycling routes.* (Parks Master Plan, p. 53)

A trail along McLennan Road is identified as Long Term Priority, targeted to be achieved in the period of 2034 – 2039 beyond. (Parks Master Plan, p. 63)

SUBDIVISION SERVICING BYLAW:

Section 406 of the Subdivision Servicing Bylaws provides that where connection to a community water system is not required and a drilled well is proposed as a source of potable water for a parcel created by subdivision in all Electoral Areas, proof of water must be provided through the submission of a well yield test which demonstrates a yield of at least 14 Litres per Minute (3.0 Imperial Gallons per Minute).

A pumping test must be carried out when a well yield test reports less than 14 Litres per Minute (3.0 Imperial Gallons per Minute or 3.7 US Gallons per Minute). A pumping test must be conducted by a Qualified Well Driller or a Qualified Well Pump Installer or a person working under the direct supervision of a Qualified Well Driller, a Qualified Well Pump Installer or a Qualified Professional. A hydrogeological report must be prepared by the Qualified Professional and submitted to the Regional District. Pumping tests of all drilled wells shall be conducted during the dry months of the year, defined as the period between August 1 and March 1, or at another time of year as confirmed in writing by the Qualified Professional in order to determine the year-round capacity of the well.

In Electoral Areas "B", "C", and "F", when a pumping test is required, the report must demonstrate that the drilled well can provide at least 6,550 litres of water per day (1.0 Imperial Gallon per Minute) per parcel. The report must demonstrate that the use of the well will not negatively impact the use of neighbouring wells.

REFERRAL COMMENTS:

The application was referred for comments to the following:

1. BC Hydro

BC Hydro has no objection in principle to the proposal, however prior to the proposed subdivision of the property, BC Hydro has the following comments for the owner:

Transmission:

1) As you know, BC Hydro has a transmission line right of way registered on the property as shown on Plan A1748. Development of the property must be guided by the terms of the right of way agreement.
2) BC Hydro must be able to make full use of the right of way area for present and future works including operation, maintenance and replacement of existing lines and construction of new lines. Any proposed use of the property must not limit BC Hydro's existing and future use of the right of way area for transmission purposes.
3) BC Hydro will require a registered agreement specifically granting access over the portions of its access route that do not fall within the surveyed Plan A1748. This appears to only potentially affect proposed Lots 2, 3, 4, 6 and 7 and we can discuss further details with the owner; i.e. the areas affected, concurrent registration, etc. BC Hydro's personnel must be able to access the right of way area at all times. The following are not permitted within the surveyed right of way area unless expressly authorized in writing by BC Hydro: log decking; blasting; burning; deposit of any fill material; buildings or portions of buildings, including foundations and eaves; stock piling of excavated, building or other material; storage or handling of flammable or explosive material; fueling of vehicles and equipment; parking of vehicles.

4) Landscaping within the right of way area is restricted to low-growing trees, shrubs and plants not exceeding 3.0 meters in height at maturity. BC Hydro (including its agents and contractors) shall have the right to remove any tall-growing trees, shrubs and plants from underneath and adjacent to BC Hydro's powerlines for line security and safety purposes from time to time.
5) There must not be any changes in ground elevations of more than 0.5 metres from the original grade of the right of way area without the prior written consent of BC Hydro. In addition, there shall be no deterioration of drainage patterns or soil stability within the right of way area.
6) No building encroachments are permitted within the right of way area.
7) Separate written approval must be obtained from this office for any intended use or development in the right of way area before construction takes place; for example driveways, septic fields, underground services, etc. Applications may be submitted directly to this office.
8) It is preferred that any habitable buildings be constructed on the East side of the transmission right of way (between the "proposed road" and the transmission right of way). Any potential crossing of the right of way area with driveways, distribution services or other utilities must first be reviewed and approved by BC Hydro.
9) Attached please find BC Hydro's compatible use guidelines for reference.
10) The final version of the subdivision plan with road dedication will require BC Hydro's signature before registration, which may be submitted to this office. BC Hydro reserves further comments following a review of the final subdivision plan when submitted.

Distribution:

BC Hydro distribution has no concerns or objections to this proposed subdivision as our infrastructure is unaffected. However, once development of the site is underway BC Hydro site servicing to the proposed development would be by design at the time of the servicing application to BC Hydro from the developer and subject to the BC Hydro extension policy in effect at the time of application.

2. Utilities Department

Outside of GVW service area boundary.

3. Ministry of Environment / Ministry of Forests, Lands, Natural Resource Operations and Rural Development

The Ecosystems Section of the Ministry of Forests, Lands, Natural Resource Operations and Rural Development provides the following response to the above noted referral.

Under the Riparian Areas Regulation (RAR) (and its update, the Riparian Areas Protection Regulation (RAPR) which came into force November 1, 2019), it is not permitted to create lots that will force development into the SPEA. If there is any danger of this being the case with subdivision as proposed, we recommend requiring preliminary RAR calculations to show the RAR-defined SPEAs (streamside protection and enhancement areas) for the two streams traversing the property before approving the rezoning request. The proponent should be able to demonstrate that there are suitable building sites outside the SPEAs in each new lot if subdivided as proposed. Furthermore, we recommend that subsequent development of individual lots be contingent upon an environmental assessment if the total area of disturbance will be greater than 0.5 ha.

4. **Community Services Department**
   From an Electoral Area B & C Parks development prospective, we support the proposed connection to the Grey Canal Trail on the south end of development. This would take people off the roadway and allow access to the Grey Canal Trail without needing to walk the full length of the road to the access point near Grey Canal Road. Development as mentioned would provide benefit the both the development of the area and the community. As approved in the Electoral Area B & C Parks Masterplan, a development of this kind would be supported.
5. **Ministry of Transportation and Infrastructure**
6. **Building Inspection Department**
7. **BX – Swan Lake Fire Department**

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