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REPORT ON

**PRELIMINARY STEPS IN THE DEVELOPMENT OF A
GROUNDWATER PROTECTION PLAN
WHITEVALE, B.C.**

Submitted to:

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EXECUTIVE SUMMARY

Golder Associates Ltd. (Golder) is pleased to present this report, which outlines the initial stages in the development of a Groundwater Protection Plan (GWPP) for the water supply well of the Whitevale Subdivision, near Lumby, B.C. It is our understanding that the Whitevale GWPP is being developed with the assistance of a gas tax grant distributed to the Regional District of North Okanagan (RDNO).

The Regional District of North Okanagan (RDNO) is the purveyor of the Whitevale water system and operates and maintains one community well (referred to as the Whitevale Well) located in the northwest area of the service lot at 715 Franklin Road. The Whitevale well was constructed in April 2006 to replace the existing supply well (Old Well), as the capacity of the Old Well had declined in recent years.

The Whitevale Well supplies potable water to approximately 100 residential lots within the Whitevale Subdivision. Given the dependence of the Whitevale water users to groundwater, the implementation of a GWPP is considered critical for the protection of the water source and water quality. The Whitevale GWPP was developed using the Well Head Protection Toolkit used as a guideline, focusing on the initiation of Steps One (Planning), Two (Capture Zone Analysis) and Three (Contaminant Inventory).

Based on the results of this initial phase of development of a GWPP for Whitevale, the following conclusions are made:

- The Whitevale Well supplies all residential water requirements for approximately 100 residential lots that are connected to the Whitevale water distribution system.
- The Whitevale Well draws water from a confined aquifer, identified in the MOE Aquifer Classification System as Aquifer No. 317 and classified as moderately utilized with a low vulnerability to contamination.
- The Whitevale Well was constructed in 2006 in accordance to GWPR standards and has a surface annular seal that extends at least 2 m into the confining layer of the aquifer.
- The lateral extents of Aquifer No. 317 are the mountain slopes to the north and south of Whitevale, Aquifer No. 352 to the west and Aquifers No. 318 and 319 to the east. Although the top of the aquifer is identified at the till/clay confining layer at a depth between 12 m below ground surface (bgs) and 21 m bgs, there are no well logs in the MOE database that are deep enough to identify the bottom of the confined aquifer.

- An examination of MOE well logs identified three wells between Bessette Creek and the Whitevale Well where a confining layer was not encountered above Aquifer No. 317, indicating the possible presence of an abandoned channel containing sand and gravel in this area. The inferred abandoned channel is likely hydraulically connected to Bessette Creek and likely acts as the recharge area for the Whitevale Well.
- An elevation and location survey was completed on four wells and the static water levels measured, which provided a groundwater flow direction in the confined aquifer to the northwest, towards Duteau Creek. The localized hydraulic gradient was calculated to be approximately 0.016 m/m. The groundwater flow direction in the shallow, unconfined aquifer is unknown.
- A water balance calculation for the Bessette Creek catchment area to the Whitevale Well provided an annual aquifer recharge estimate of 1.3×10^7 m³/year, annual extraction range of 6.9×10^5 m³/yr to 8.7×10^5 m³/yr and an annual net surplus of 1.2×10^7 m³/yr. The utilization rate calculated was approximately 6%. (Note this calculation is for all aquifers in the unconsolidated valley bottom materials. There is insufficient information to complete a water balance solely for the confined aquifer).
- The preliminary 60-day time-of-travel zone of the Whitevale Well was estimated using an analytical equation method based on known aquifer parameters and the maximum recommended pumping rate for the Whitevale Well. Longer time-of-travel zones (for example, 1-year time of travel) were not calculated because the 60-day time-of-travel zone intersected a positive recharge boundary. As the 60-day time-of-travel zone is strongly influenced by the groundwater flow direction and hydraulic gradient, a buffer area around the 60-day time-of-travel zone was also estimated to compensate for potential seasonal fluctuations in groundwater conditions.
- The southern boundary of the 60-day time-of-travel zone intersected an inferred abandoned channel of Bessette Creek, located at approximately 175 m south of the Whitevale Well. This corresponds to the positive recharge boundary identified approximately 200 m from the Whitevale Well based on the results of the pumping test completed at the time of construction.
- A preliminary Groundwater Under the Direct Influence of surface water (GUDI) assessment indicated that the Whitevale Well does not meet criteria that would flag the well as potentially GUDI.
- The contaminant inventory indicated residential and agricultural land uses within the 60-day time-of-travel zones of the Whitevale Well.

- Inactive or old wells, including the Old Well, domestic septic systems and a neighbouring high density feed lot (or over-wintering pasture) are considered very high priority in regards to the risk of contamination to the Whitevale Well.
- The inferred abandoned channel of Bessette Creek and suspected inactive wells within the 60-day time-of-travel zone and buffer area are considered to represent a high priority contaminant risk to the Whitevale Well.
- Moderate priority contaminant risks to the Whitevale Well were identified as agricultural land used to grow crops, potential spills from accidents on the roads, use of road salt and residential land use.

The following nine recommendations are made in regards to further assessing the water quality risks to the Whitevale Well from the surrounding land use and to refine the areas that could potentially impact the water quality:

1. Determine the Groundwater Flow Direction of the Shallow Aquifer

Due to the uncertainty of the influence of the shallow aquifer on the 60-day time-of-travel zone of the Whitevale Well, the groundwater flow direction of the shallow aquifer should be assessed. Although it may not change the 60-day time-of-travel zone identified for the Whitevale Well, since this is calculated for the source aquifer, this information will assist in refining the buffer area around the 60-day time-of-travel zone to the Whitevale Well and in guiding the recommendations that follow.

2. Conducting a Neighbourhood Survey and Education Program

Since inactive and old wells present a high risk to the water quality in the confined aquifer, a door-to-door survey should be undertaken of all properties in the 60-day time-of-travel zone and buffer area to identify all water wells. Each well should be visually inspected and the following should be documented:

- ⇒ the well location (with GSP coordinates if possible) and surrounding land-use,
- ⇒ exterior condition of well should be photo-documented with comments on the well cap, pump house, condition of well casing above ground, and potential for ponding at the ground surface,
- ⇒ well depth and static water level,
- ⇒ age of well and current use, and

- ⇒ collecting well logs from residents if not provided in MOE Well Database (if available).

Once this information is collected, the risk that each well presents to water quality in the confined aquifer can be assessed. A management strategy for each well can then be developed that details any work required and a timeline. Further work that may be required may include increased monitoring, improvements to the well cap, surface seal, videotaping the well to check the well condition or well decommissioning. Timelines should be dictated by the risk the well presents to the water quality of Aquifer 317.

If a door-to-door survey is conducted, this opportunity should also be utilized to provide public education and to gather more comprehensive information about potential water quality risks, by:

- ⇒ collecting information about the types and quantities of chemicals used,
- ⇒ identifying septic tank and field locations,
- ⇒ identifying dry wells and the existence of road-side ditches and their drainage patterns,
- ⇒ providing information to property owners about the risk of their on-site activities to the local groundwater quality and to their own drinking water, and
- ⇒ providing best management practices in relation to reducing their impacts to the local groundwater.

3. Aquifer Monitoring

The residential septic systems and cattle feed lot present a high risk to local groundwater quality. Potential migration routes of associated contaminants to the confined aquifer are through old or inactive wells and infiltration in the unconfined area of the aquifer (i.e. the recharge area represented by the inferred abandoned channel). A limited groundwater monitoring program is recommended to provide early warning of impending water quality problems at the Whitevale Well. This program would focus on monitoring of water quality in the shallow aquifer and in the potential recharge area of the deeper aquifer.

Some suggestions for the development of a monitoring program are as follows:

- ⇒ Utilizing one or two existing wells completed in the shallow aquifer to sample and analyze for parameters related to septic fields, road salt and cattle operations (i.e. sodium, chloride, phosphorus, ammonia, nitrate/nitrite, metals,

Total Coliform and E. Coli). Wells completed in the shallow aquifer that might be candidates for sampling are WTN # 8475, 3270 and the private well located at 495 Whitevale Road (not identified within the MOE Well Database).

- ⇒ Utilizing one or two of the existing wells completed in the potential recharge zone of the Whitevale Well to test for parameters related to septic fields and cattle operations (i.e. phosphorus, ammonia, nitrate/nitrite, metals, Total Coliform and E. Coli). Wells completed in the potential recharge zone of the Whitevale Well that might be candidates for sampling are WTN # 57246, 41504 and 58436.
- ⇒ The parameters outlined above should be re-examined to include relevant information obtained from the door-to-door surveys. For example, if it is discovered during the door-to-door surveys that a particular property has an oil storage tank of questionable condition, then parameters relating to heavy petroleum hydrocarbons may be recommended in the sampling plan.
- ⇒ the suggested monitoring frequency of sampling is quarterly for two years. The results can then be reviewed to assess if more or less monitoring is required.
- ⇒ Samples collected should be submitted to a *Canadian Association for Environmental Analytical Laboratories* (CAEAL) certified laboratory for analysis.

4. Developing an Action Plan for the Old Well

The Old Well at the Whitevale service lot is within the 60-day time-of-travel zone and likely does not have an annular seal to prevent the migration of contaminants from the shallow aquifer to the confined aquifer. This presents a risk to the water quality in the Whitevale Well. However, the Old Well may be useful as a monitoring well, an emergency back up well or for a short-term supply well in the future when rehabilitation of the Whitevale Well is required.

Since there are both advantages and disadvantages to keeping the Old Well operable but inactive, the value of the Old Well to RDNO should be assessed and an action plan formulated. This assessment should be carried out once additional information related to groundwater flow (Recommendation #1) and groundwater quality monitoring (Recommendation #3) becomes available. At this time, there are potentially three options that could be examined:

Option 1 – the Old Well is decommissioned according to the GWPR code of practice to ensure contaminants can not migrate from the shallow aquifer to the confined aquifer via the well casing or annular seal. This scenario would be recommended if the monitoring program indicates that the shallow aquifer has a high level of contaminant loading from surrounding land-use activities.

Option 2 - the Old Well is left inactive but in an operable state and included in the emergency response and contingency planning as a backup well. This option would only be considered if the contaminant loading in the shallow aquifer does not represent a risk to the confined aquifer.

Option 3 - the Old Well is upgraded by installing a surface annular seal and left inactive but in an operable state and included in the emergency response plan as a backup well. This option would be considered if it was determined that the Old Well has considerable value as a back-up well but the contaminant loading in the shallow aquifer and risks from surrounding land-use is too great to leave in it's original state. According to the construction details of the Whitevale Well, the aquitard layer starts at about 1.8 mbgs and therefore an annular surface seal would need to penetrate into this layer.

5. Monitor Performance of Whitevale Well

In addition to the static and pumping water levels that the RDNO currently monitors at the Whitevale Well, it is recommended that pumping rates and the duration of pumping be recorded on a monthly basis to assess well performance. It is also recommended that water levels in the Old Well continue to be monitored (unless it is decommissioned). This information should then be reviewed annually by a qualified professional to assess well efficiency, and potentially identify early indications of well deterioration.

6. Designate Groundwater Protection Areas

Following refinement of the buffer area based on the groundwater flow direction of the shallow aquifer, the RDNO should designate formal groundwater protection areas. Two different strategies can be employed when designating groundwater protection areas: i) a wellhead protection approach, whereby groundwater protection area is defined relative to a designated time-of-travel zone or, ii) an aquifer protection approach, whereby part or all of an aquifer is designated for protection. For example, the RDNO may wish to consider designating the potentially unconfined (recharge) area of the Aquifer No. 317 as a groundwater protection area.

The RDNO may also wish to identify one or more contingency areas for protection in the event that the Whitevale Well becomes contaminated. The advantage of defining protection areas in this manner is that it allows for the protection of groundwater recharge areas, surface

water quality, areas serviced by private water wells and areas where future water supplies may be developed.

7. Develop Groundwater Protection Measures

Once designated groundwater protection areas have been established and additional potential contaminant sources have been identified, RDNO should embark on the development of groundwater protection measures. Groundwater protection measures can be implemented at the municipal level through both regulatory and non-regulatory measures. In our opinion, while non-regulatory measures, such as public education and best management practices, can be highly effective, some degree of regulatory control may be required to ensure the protection of the groundwater resources.

These regulatory strategies often involve the use of municipal land use planning and zoning bylaws to restrict certain high-risk land use activities within protection areas. As an alternative to land use restrictions, some communities, such as Fredericton, New Brunswick, have chosen to restrict the types and quantities of chemicals used within groundwater protection areas.

RDNO may want to initiate discussions with the owner of the cattle feed lot and other agricultural land owners within the 60-day time of travel capture zone of the Whitevale Well regarding protection measures. Discussions should focus on possible alternative locations to over winter cattle, or at a minimum, restricting cattle from the recharge area of the Whitevale Well and about types of chemical uses within this area that pose a risk to groundwater quality and whether legal restrictions are required.

Public participation and education represents one of the most important forms of non-regulatory groundwater protection. It is essential to the success of a groundwater protection plan and provides a means of securing political and financial support. A public education campaign would identify groundwater protection areas, threats to groundwater supplies in those areas, and measures residents can take to protect the resource. Examples of public education tools include the use of the public information meetings, signs erected at strategic locations around groundwater protection areas, the use of media, distribution of information brochures on best management practices and school education programs.

In addition, the following recommendations are made regarding groundwater protection measures:

- Prepare an educational brochure or pamphlet aimed at all of Whitevale and the surrounding area residents for:
 - The proper application of fertilizers and pesticides (with an emphasis away from utilization of pesticides and chemical fertilizers).

- The importance of good handling and disposal practices of household chemicals and the potential impact of these chemicals on the groundwater quality in Whitevale.
- Best management practices for the operation and maintenance of septic tanks and effluent disposal fields.
- The potential impacts of stormwater runoff.
- RDNO may also want to consider restrictions for pesticide and fertilizer use in sensitive areas, with no-spray zones around water supply wells. In addition, contingency plans should be prepared in the event of a pesticide or fertilizer spill or accident. Mixing of chemicals and refilling of containers, spray and applicators should be completed in contained areas away from wells, water sources, and areas characterized by permeable soil conditions.

8. Update Emergency Response Plans

The main goal of GWPPs is to prevent the contamination of underground drinking water supplies. Even under the best prevention plans, a scenario that threatens to contaminate the aquifer may occur. When this happens, emergency response plans direct a coordinated and timely response to assure a continued supply of potable water. Many communities have an emergency response plan, however they often do not include specific provisions for the protection of groundwater resources in the event many emergency situations. For example, it may be prudent for emergency response personnel to restrict the use of fire retardant chemicals in sensitive groundwater areas.

RDNO currently has an Emergency Response Plan for the Whitevale water supply; however it requires revision and may not include all possible hazards as identified in this Study. We recommend that RDNO update and revise the emergency response plan for the Whitevale Well.

9. Develop Contingency Plans

Contingency planning consists of developing a plan for the location and provision of an alternative drinking water supply in the event that the existing supply cannot be used. This is important for the Whitevale Subdivision as they only have one well supplying all their water. It is recommended a contingency plan be developed for the Whitevale Subdivision. The contingency plan should identify short-term alternatives in the event of a minor disruption, and long-term alternatives in the event of a complete loss of water supply.

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LIST OF ACRONYMS

ALR	Agricultural Land Reserve
CAEAL	Canadian Association for Environmental Analytical Laboratories
CSRD	MOE Contaminated Sites Registry Database
CFR	Calculated Fixed Radius
GWPP	Groundwater Protection Plan
GWPR	British Columbia Groundwater Protection Regulation
GUDI	“Groundwater Under the Direct Influence” of surface water
IHA	Interior Health Authority
L/s	litres/second
MAFF	Ministry of Agriculture, Food and Fisheries
masl	meters above sea level
m bgs	meters below ground surface
MHS	Ministry of Health Services
MOE	British Columbia Ministry of Environment
OMOE	Ontario Ministry of Environment
RDNO	Regional District of North Okanagan
USgpm	US gallons per minute
WPT	Well Protection Toolkit
WRA	MOE Water Resources Atlas
WTN	Well Tag Number (as provided in the MOE Well Database)

1.0 INTRODUCTION

Golder Associates Ltd. (Golder) is pleased to present this report, which outlines the initial stages in the development of a Groundwater Protection Plan (GWPP) for the water supply well (herein referred to as the “Whitevale Well”) of the Whitevale Subdivision in the rural community of Whitevale, near Lumby, B.C. (Figure 1). This work was completed at the request of the Regional District of North Okanagan (RDNO), which is the purveyor of the water distribution system for the Whitevale Subdivision. It is our understanding that the Whitevale GWPP is being developed with the assistance of a gas tax grant distributed to the Regional District of North Okanagan (RDNO).

The Whitevale Well supplies potable water to approximately 100 residential lots within the Whitevale Subdivision and is located in the northwest area of the service lot at 715 Franklin Road, as shown on Figure 2. Given the dependence of the Whitevale Well water users on groundwater, the implementation of a GWPP is considered critical to the protection of source water quality. Implementation of groundwater protection measures will not only help to protect public health, but will also protect ecosystems associated with the creeks and rivers that rely on groundwater as a source of recharge.

This work was authorized by Mr. Bob Campbell of RDNO on April 18, 2007 and follows the methodology contained in a proposal submitted by Golder on March 6, 2007.

2.0 BACKGROUND

RDNO operates and maintains one community water supply well within the Whitevale subdivision referred to as the “New Whitevale Well”. This well was constructed in April 2006 to replace the existing well on the site (Old Well), as the capacity of the Old Well had declined in recent years.

Golder previously completed the following two reports pertaining to the community wells (Old Well and Whitevale Well) in Whitevale:

- *Preliminary Hydrogeological Assessment, Whitevale Subdivision, 715 Franklin Road, Whitevale, B.C.* dated May 17, 2005 (project # 05-1440-067), and
- *Hydrogeological Services for Design, Construction and Yield Testing of the New Community Well for Whitevale, B.C.* dated August 9, 2006 (project # 06-1440-022).

The first report was completed at the request of the Interior Health Authority (IHA) following an application submitted by RDNO to drill the new well in 2004. The report identified potential sources of contaminants in the immediate area that could pose a risk to the new well

(i.e., septic tanks, septic fields, roads, etc.) and outlined provisions for well construction to minimize those risks.

The construction report outlines the construction details of the Whitevale Well, provides an analysis of pumping tests and presents conclusions and recommendations. One of the recommendations of this report was that RDNO consider developing a Groundwater Protection Plan for the Whitevale Well. The development of a GWPP assists communities in identifying important characteristics pertaining to their groundwater source and guides them in the development of management strategies to protect their resource. This is conducted on the premise that it is much more cost effective to protect a water supply source from potential contamination than to remediate contamination and/or develop a new water supply source(s).

3.0 METHODOLOGY

The Well Protection Toolkit (WPT) was used as a guide in the development of the GWPP. The WPT was developed jointly by Ministry of Environment (known previously as the Ministry of Water, Land and Air Protection) and the Ministry of Health in 2000, and consists of a six-step process created to assist communities that utilize groundwater to better manage and protect their drinking water sources.

The six steps outlined in the WPT are as follows:

- Step 1. Form a Community Planning Team;
- Step 2. Define the Well Protection Areas;
- Step 3. Identify Potential Contaminants;
- Step 4. Develop Management Strategies;
- Step 5. Develop Contingency Plans; and
- Step 6. Monitor Results and On-going Evaluation of the Plan.

For this study, the basic components of the first three steps (Steps 1 to 3) of the WPT were followed. However, based on Golder's experience with developing GWPPs, it was determined that the best approach in completing the Whitevale Well GWPP was to complete the technical aspects of the study before forming a Community Planning Team and public initiating involvement in the GWPP. With this in mind, the initial emphasis of the study was on defining the 60-day time-of-travel capture zone for the Whitevale Well and identifying potential threats to the water source from surrounding land use. Once the technical information presented in this report is reviewed and finalized, it can be presented to the public for review and input.

The following provides the specific scope of work for this initial phase of the GWPP:

- Gather and review available information on the community well and local aquifer(s);

- Complete a location and elevation survey of the Whitevale Well, the Old Well and one or two private wells and collect static water levels of the surveyed wells to estimate a groundwater flow direction and hydraulic gradient,
- Identify aquifer characteristics in the area and estimate the extent of the 60-day time-of-travel capture zone for the Whitevale Well by incorporating the groundwater flow direction and hydraulic gradient information,
- Complete a preliminary contaminant inventory for the Whitevale Well, which will include reviewing available information (land use maps, zoning bylaws, air photographs, etc.), completing a search of the Ministry of Environment (MOE) Contaminated Sites Registry Database (CSRD), conducting interviews with representatives of relevant government agencies and conducting a windshield survey of the area,
- Prepare a report summarizing the study, and
- Present the findings of the report to Whitevale community members via a public open house meeting.

It is understood that further progress in the development of Whitevale's GWPP (the completion of Steps 4, 5 and 6) will be based on the findings of this report and will be a function of funding availability. Issues related to existing water quality monitoring were beyond the work scope for this initial stage of GWPP and should be addressed in future stages of this initiative (i.e. Step 6).

4.0 STUDY AREA

4.1 Location and Climate

The Whitevale Well is located in the Whitevale Subdivision, approximately 2.5 km southwest of Lumby, BC. The Subdivision is located in the Bessette Creek Valley, approximately 400 m northwest of Bessette Creek (at its closest point) and is at an elevation of approximately 525 meters above sea level (masl). The geographic coordinates of the Whitevale Well are: Latitude 50°13'14.2"N, Longitude 118°59'44"W. Figure 1 shows the location of the Whitevale Subdivision and the approximate area considered for this GWPP. The land use within the subdivision is residential with agricultural and residential land surrounding the subdivision.

The climate of Whitevale consists of warm summers and cool, moist winters. The closest weather station to Whitevale is located in Lumby. The "Lumby Sigalet Rd" weather station is located at an elevation of 560 masl. Data from this weather station indicates the annual average daily temperature of Lumby is 6.7° C, with daily average temperatures ranging

from -4.9° C in January to 17.9° C in July, as reported in “Canadian Climate Normals, 1971 – 2000 for BC” (Environment Canada). The total annual precipitation reported for Lumby is 628.3 mm per year.

4.2 Topography

The local topography in the Whitevale area is characterized by a flat valley bottom surrounded by steep slopes to the north and south. The valley bottom represents the floodplain area of the Bassette Creek, which is a tributary of Duteau Creek. The valley generally runs in an east to west direction and is bounded to the north by Silver Star Mountain (peak elevation of approximately 1890 masl) and to the south by Buck Mountain (peak elevation of approximately 2000 masl).

The catchment area of Bassette Creek upgradient of Whitevale generates runoff from rainfall and snowmelt, which also contributes recharge water to the local aquifers in Whitevale. The catchment area of Bassette Creek upgradient of Whitevale is shown in Figure 3 and is approximately 250 km².

4.3 Overview of Surficial and Bedrock Geology

Apart from providing a physical boundary that the unconsolidated sediments of the valley are situated within, the bedrock in the Study Area is expected to provide minimal recharge to the local groundwater flow regime. According to the BC Geological Survey website¹, Whitevale is underlain primarily by granodioritic intrusive rock from the Middle Jurassic Period.

5.0 HYDROGEOLOGICAL ASSESSMENT

5.1 Review of the Preliminary Hydrogeological Assessment

A hydrogeological assessment of the area was completed in the previous Golder report entitled *Preliminary Hydrogeological Assessment, Whitevale Subdivision, 715 Franklin Road, Whitevale, B.C.*, dated May 17, 2005.

A summary of the findings within the Preliminary Hydrogeological Assessment are as follows:

- Three aquifers were identified in the area of the Whitevale Subdivision according to the Aquifer Classification System compiled by MOE; Aquifer Nos. 315, 316 and 317. The aquifer extents and classifications, as identified in the MOE Water Resources Atlas (WRA) are provided in Appendix I.

¹ <http://www.em.gov.bc.ca/Mining/Geosurv/MapPlace/themeMaps.htm>

- Based upon a review of the available well logs in the area, there appears to be an upper unconfined, sand and gravel aquifer and a lower, confined, sand and gravel aquifer. The upper aquifer is separated from the lower aquifer by a 4 m to 12 m thick till and/or clay unit(s). Well logs in the area from the MOE Well Database are provided in Appendix II)
- The upper unconfined aquifer is assumed to be represented by Aquifer No. 315 & 316 in the MOE Aquifer Classification System (Appendix I). The well logs in the area indicate that the shallow aquifer ranges in depths from 3 m and 18 m (10 feet and 58 feet) with reported static levels of between 0.6 meters below ground surface (mbgs) and 10 mbgs (2 feet and 34 feet). Aquifer Nos. 315 and 316 are classified as moderate and low yielding sand and gravel aquifers, respectively, with a high vulnerability to contamination from surface sources.
- Aquifer No. 317 is assumed to represent the confined aquifer. The top of the confined aquifer has a reported depth of between 12 mbgs and 21 mbgs (39 feet and 68 feet). Static water levels reported in these wells at the time of drilling were between 3 mbgs and 9 mbgs (9 feet and 30 feet). Aquifer No. 317 is classified as a moderate yielding sand and gravel aquifer, with a low vulnerability to contamination from surface sources.

5.2 Municipal Groundwater Use

The Whitevale Well is the only well in the study area that is known to service more than one property owner. The well log for the Whitevale Well indicates sand and gravel exists from the ground surface to 1.8 mbgs, underlain by a layer of sand, gravel and clay (classified as “likely till”) from 1.8 mbgs to 8.7 mbgs, with sand and gravel from 8.7 mbgs to 26.8 mbgs (Golder, 2006). The surficial stratigraphy and construction details for the Whitevale Well are provided in Figure 4.

5.3 Other Groundwater Users

All other wells in the area are private wells used for household domestic water, irrigation or other agricultural purposes. A comprehensive inventory of these private water wells was beyond the scope of this study. However, Golder assembled the following information concerning local groundwater use.

The location of 33 known water wells identified in the MOE database for the study area, including the Old Whitevale Well, are shown in Figure 5 and the well logs are provided in Appendix II. Although little is known about these wells, most are located outside the service area of the Whitevale distribution system, and therefore, most are assumed to still be in use.

5.4 Aquifer Characteristics

Based on existing well logs in the area, Aquifer No. 317, the source aquifer of the Whitevale Well, is confined by a till/clay layer that represents the top of this aquifer, but there is no information concerning the total thickness of the aquifer. Anecdotal reports from local residents indicate that deeper wells in the area have produced flowing artesian conditions, which indicates that there may be another deeper aquitard(s) and aquifer(s) above the bedrock.

The MOE Aquifer Classification System indicates that the lateral extents of Aquifer No. 317 consist of a bedrock boundaries to the north and south and a change in stratigraphy to the east and west. To the north and south, Aquifer 317 ends at the slopes of the surrounding mountains, where the aquifer likely encounters bedrock. To the west, Aquifer 317 ends at Coldstream Creek, where it encounters Aquifer 352. To the east, Aquifer 317 encounters Aquifers 318 and 319, which is apparently the end of this stratigraphy layer. The extents of Aquifer 317 are provided in Appendix I.

Based on a 52-hour pumping test conducted on the Whitevale Well at the time of construction, the transmissivity of the confined aquifer was estimated to be $740 \text{ m}^2/\text{day}$ with a storage coefficient of 0.008 (Golder, 2006). The hydraulic conductivity is $5 \times 10^{-4} \text{ m/s}$ based on a saturated aquifer thickness of 18.1 m. This is consistent with data found in the literature which provides a hydraulic conductivity range of 10^{-4} m/s to 10^{-2} m/s for sand and gravel (Freeze & Cherry, 1979).

The 52-hour pumping test analysis indicated the presence of a positive recharge boundary approximately 200 m from the Whitevale Well. Further examination of the MOE well logs determined that for three wells (WTN 57246, 41504 and 58436) located between Bessette Creek and the Whitevale Well the confining layer above Aquifer No. 317 appears to be absent. This indicates that these three wells may be constructed within an abandoned channel that is likely hydraulically connected to Bessette Creek. The inferred location of this abandoned channel is provided in Figure 5. WTN 41504 is approximately 170 m from the Whitevale Well, and hence, the inferred abandoned channel may represent the positive recharge boundary identified by the pumping test.

5.5 Groundwater Flow Direction and Hydraulic Gradient

To determine the hydraulic gradient of Aquifer No. 317, the location and relative elevation of four wells were surveyed² on May 24, 2007 and the static water levels recorded. The Whitevale Well and the Old Whitevale Well were included in the study, together with two private wells located at 735 Arbutus Road (not identified within the MOE database) and 487 Whitevale Road (WTN 43930). The resultant groundwater flow direction was determined to

² The survey conducted used a local coordinate system and was not referenced to mean sea level.

be to the northwest (Figure 6), towards Duteau Creek (Figure 1). The localized hydraulic gradient was calculated to be approximately 0.016 m/m.

A second round of water-level measurements was collected on Nov. 6, 2007. The water levels were measured after the wells were allowed to stabilize (during a period of non-pumping) for at least 8 hours (overnight). The groundwater flow direction and gradient measured during the second round were consistent with the first round.

It should be noted that the groundwater flow direction and hydraulic gradient measured in the confined aquifer do not necessarily apply to the shallow aquifer. Also, the groundwater flow direction and hydraulic gradient may experience seasonal variations.

5.6 Aquifer Water Balance

5.6.1 Recharge

The estimated annual recharge to the aquifers was calculated based on climatic data, assuming that recharge to the aquifer occurs primarily via precipitation infiltration within the catchment areas of the Bessette Creek watershed.

As seen in the table below, a wide range of recharge rates can occur, from fractions of a percent of total precipitation in arid and semi-arid areas (where evaporation is high) to approximately 25 percent in some higher alpine areas and on flat lying alluvial fans. Studies in Keremeos (Golder, 2003) indicated that using climate data with a 10% infiltration rate provided a good agreement between with the Darcy Flux estimate that was conducted for the Keremeos Aquifer. The topography and climate patterns in Keremeos are similar to those found in most areas of the Okanagan Valley.

Location	Aquifer Recharge Rate Used	Reference
Semi-arid Lillooet, B.C., alluvial fan (low angle)	24% (397 mm/yr)	Golder, confidential report
Prince George, B.C., valley bottom	17% (614.6 mm/yr)	Golder, confidential report
Semi-arid, West Texas, USA	2% (330 mm/yr – 560 mm/yr)	Wood and Sanford, 1995
Florida sub tropical, USA	0.2% to 0.3% (1400 mm/yr)	Fetter, 2001
High Plains (Colorado, Kansas, Nebraska, New-Mexico, Oklahoma, South Dakota, Texas, Wyoming; USA)	3.5%-6% (410 mm/yr -710 mm/yr) (average for entire area)	Fetter, 2001
Keremeos, B.C., valley bottom with surrounding mountain slopes	10% (300.9 mm/yr)	Golder, 2003

Based on the similarities between Keremeos and the Whitevale Subdivision, a 10% recharge from precipitation was used to estimate the recharge to all the local aquifers in Whitevale. It was also assumed that the majority of the infiltration (estimate of 80%) is concentrated in the alluvium sediments within the base of the valley with the remainder of the infiltration (20%) recharging localized bedrock aquifer systems.

The annual recharge calculation uses the mean annual precipitation reported for the Lumby Sigalet Rd weather station of 628.3 mm/yr and assumes that approximately 10% of this precipitation, or 62.8 mm/yr, is available as recharge to the local aquifers. Of this, 80% or 50.3 mm/yr is directed to the alluvium sediments in the valley with 12.5 mm/yr to the local bedrock aquifers. This recharge availability is then multiplied by an area of 250 km², the approximate catchment area of Bessette Creek above Whitevale (Figure 3), to get an annual aquifer recharge of 1.3×10^7 m³/year in the Whitevale area. This recharge estimate is for the recharge in all the local aquifers in the unconsolidated materials. There is currently not enough information to estimate the portion of this recharge that is directed to the confined aquifer that is the source for the Whitevale Well.

Note that this recharge estimate is based on precipitation only and does not account for other sources of recharge to the aquifer such as return flow from Bessette Creek, septic fields, irrigation, water system leaks and run-off from surrounding uplands.

5.6.2 Extraction

The Whitevale Well is metered and according to RDNO records, the approximate extraction total for 2006 was 36,713 m³.

There is no information available on the extraction rates of the private wells in the area. Without metering data it is difficult to quantify the aquifer discharge or total annual groundwater extraction for all wells in the area. However, an annual discharge rate was estimated for the catchment area of Bessette Creek to Whitevale by estimating the water usage based on the number of houses and irrigated agricultural land in the catchment area. The estimated annual discharge for all the aquifers in the area was calculated to be within a range of 6.9×10^5 m³/yr to 8.7×10^5 m³/yr. The following outlines the assumptions used in developing the estimate:

- An estimate of 150 houses are located within the Bessette catchment (not including the Whitevale Subdivision) based on the MOE groundwater atlas. It is assumed that all houses in the area utilize local groundwater. Assuming a residency population of 2.5 people per household³, the local population was estimated to be approximately 375 people. Based on the BC Sewage System Standard Practice Manual (MHS, 2005), the average domestic water use is in the range of 0.40 to 0.60 m³/day/person.

³ Based on BC stats for Lumby from 2001 Census Population Statistics.

This provides a local domestic water use of 190 m³/day to 225 m³/day (6.8×10⁴ m³/year to 8.2×10⁴ m³/year);

- The water used for agricultural purposes is estimated to range from 5.9×10⁵ m³/yr to 7.5×10⁵ m³/yr. This was based on an irrigated crop water demand ranging from 33 cm to 41 cm per year applied over an estimated 180 hectares of potentially irrigated land. The irrigated crop water demand was calculated using the “Guide to Irrigation System Design with Reclaimed Water”, an Irrigation Fact sheet issued by the BC Ministry of Agriculture, Food and Fisheries, February 2001. The amount of irrigated land used in this calculation is the approximate amount of agricultural land within the catchment area of Bessette Creek to the Whitevale Well.

This estimate does not account for leaks or losses from the Whitevale distribution system or from private systems. It was assumed that there is no industrial or commercial land use in the Bessette Creek catchment area to Whitevale.

5.6.3 Surplus

The overall water balance in the area can be estimated using the following equation:

$$Q_{recharge} - Q_{extraction} = Q_{net\ surplus}$$

The following water balance includes the total extraction and total annual recharge estimates for the Bessette Creek catchment area to the Whitevale Well.

The total aquifer recharge was calculated to be approximately 1.3×10⁷ m³/yr. The estimated annual groundwater extraction calculated ranges from 6.9×10⁵ m³/yr to 8.7×10⁵ m³/yr. Based on these estimates, the total net surplus of the local aquifers available is 1.2×10⁷ m³/yr (no range is provided based on significant figures). From these estimates, the current utilization rate of water from the aquifer at Whitevale is approximately 6%.

The above utilization rate does not account for reductions in well yields created by the lowering of available drawdown in wells during drought or the effects of climate change.

6.0 WELL PROTECTION TOOLKIT

6.1 Step 1 - Community Planning

During the development and implementation of a GWPP, it is important to include the interests of community members and land-users. Step 1 of the WPT consists of the formation of a Community Planning Committee to assist in the GWPP development. However, based on Golder’s past experience and on the size of the Whitevale Community, it was determined that the most beneficial approach would be to focus on gathering the technical information

required for a GWPP before soliciting input from the public. The results of this study can then be presented to the Whitevale water uses and land users for input.

6.2 Step 2 - Define Well Protection Areas

6.2.1 General

During the pumping of a well, groundwater is removed from a finite volume of the aquifer. In the initial phases of pumping, the drawdown cone created by the well expands and groundwater is removed from storage within the aquifer (due to pore drainage, aquifer matrix compression, and water compressibility). In later stages, once the drawdown cone attains sufficient dimensions and/or intersects a positive recharge boundary, groundwater flows radially towards the well and the aquifer is replenished by recharge due to precipitation and/or leakage from streams, rivers, and geologic units bounding the aquifer.

To efficiently manage and protect a groundwater supply, an understanding of the well “capture zone” and the “time-of-travel” zones are required. A “capture zone” is the area of an aquifer from which all groundwater will eventually arrive at the well, even after a considerable amount of time. A “time-of-travel” zone is the area of an aquifer from which groundwater will be derived in a predefined amount of time. For example, if a contaminant is released within the 1-year time-of-travel zone, it can be expected to arrive at the well within approximately 1 year. Once the capture zone and time-of-travel zones are estimated, the appropriate monitoring and protective measures can be implemented.

The following sections outline the methodology used in the time-of-travel zone analyses, limitations of the analysis and the results of the analysis.

6.2.2 Modeling Methodology and Limitations

Several methods of time-of-travel zone analysis exist including: 1) calculated fixed radius method (CFR), 2) type curves and analytical equations, and 3) numerical flow and transport models. The methods vary in their accuracy and applicability, with Methods 1 and 2 being restricted to relatively simple groundwater regimes, and Method 3 being capable of addressing scenarios with more complicated hydrostratigraphy, hydrogeologic boundaries, and variable pumping scenarios. Although more technically rigorous, Method 3 requires considerably more effort and data regarding hydrogeologic conditions, which are beyond the scope of this project.

Since the hydraulic gradient and groundwater flow direction were measured as part of this study and a number of the aquifer parameters have been estimated from previous studies, Golder utilized an analytical equations method that incorporates these parameters to estimate the 60-day time-of-travel zone for the Whitevale Well. Time-of-travel zones longer than 60-

days (for example, 1-year and 5-year time of travel zones) were not analyzed as the 60-day time-of-travel zone intersects a positive recharge boundary, as detailed in the proceeding sections.

The 60-day time-of-travel zone is generally accepted as the approximate time required for the renovation of biological pathogens in groundwater (Matthess, 1985).

The following presents a brief outline of the analytical equations method utilized and the limitations of this method.

Analytical Equations

The analytical equations method utilized was developed by Ceric and Haitjema (2005) as presented in their paper in the technical journal, *Groundwater*. It incorporates the local hydraulic gradient, groundwater flow direction, aquifer parameters (hydraulic conductivity, porosity and thickness) and the pumping rate of the subject well.

This method presents various options for determining the time-of-travel capture zone, which are defined based on the average groundwater velocity in the aquifer, the aquifer porosity and hydraulic conductivity. In general, aquifers with relatively flat hydraulic gradients result in more circular capture zones, while steeper hydraulic gradients results in oval or elongated capture zones extending upgradient of groundwater flow direction.

Although this method provides a more realistic estimate of the time-of-travel zones than the circular CFR method, it has the following limitations:

- It does not account for seasonal groundwater fluctuations, interactions with other wells, or boundary conditions.
- Dispersion, degradation or retardation of contaminants in groundwater are not taken into consideration.
- Only one constant pumping rate is utilized in the equations, when in reality, pumping rates vary on a daily and seasonal basis.
- The time-of-travel zone calculated is highly dependant on the groundwater flow direction and hydraulic gradient, which may fluctuate on a seasonal basis, changing the area and orientation of the time-of-travel zone.

6.2.3 Time-of-travel Zone Results

For the purpose of this study, Golder Associates carried out a preliminary analysis of the 60-day time-of-travel zone for Whitevale Well. The pumping rate used in the analysis was 7.6 L/s (120 USgpm), the recommended maximum yield provided in the construction report of the Whitevale Well (Golder, 2006). Hence, the time-of-travel zone calculated is considered conservative (likely larger than actual conditions) as the Whitevale Well is not normally pumped continuously.

The results of the preliminary 60-day time-of-travel zone estimates using the analytical equations method are provided in the table below and shown in Figure 6.

Whitevale Well Time-of-Travel Zone	Analytical Equations (Ceric and Haitjema, 2005)		
	Maximum Width (m)	Distance Upgradient (m)	Distance Downgradient (m)
60-day	28	184	9

The results of the analytical equations method used indicate that the extent of the 60-day time-of-travel zone intersects the inferred abandoned channel of Bessette Creek, approximate 175 m to the south of the Whitevale Well. The abandoned channel (Figure 5) is likely hydraulically connected to Bessette Creek and, as indicated in the pumping test results (Golder, 2006), acts as a positive recharge boundary. It is anticipated that time-of-travel zones greater than 60-days will not extend beyond this positive recharge boundary in the pattern predicted by the analytical equations method and therefore, estimates for times greater than 60-days were not calculated.

It is important to note that the area estimated for the 60-day time-of-travel zone using the analytical equations method is highly dependant on groundwater flow direction and gradient. It is possible that the direction of groundwater flow varies seasonally and the 60-day time-of-travel zone may also change accordingly. To account for this uncertainty, Figure 7 also provides a buffer area around the 60-day time-of-travel zone. The buffer area is based on an estimate of potential variations in groundwater flow direction and gradients as there is insufficient information available to determine the actual extents of the buffer area.

It should also be noted that should the water level elevation within the Whitevale Wells fall below the base elevation of the positive recharge boundary (i.e. inferred abandoned channel), it is possible that the time-of-travel zones may extend beyond this boundary. Also, the 60-day time-of-travel zone provided in Figure 7 is within the confined aquifer and does not necessarily apply to the shallow aquifer. If the groundwater flow direction is in another direction in the shallow aquifer, it is possible that land use activities outside of the current 60-day time-or-travel and associated buffer zone may represent a risk to the shallow

groundwater quality. This may, in turn, impact the deeper aquifer if a pathway exists between the two.

The estimates completed must be considered preliminary only. However, they represent a reasonable first approximation for Whitevale GWPP by providing an indication of the reaction time available in the case of threats to the groundwater supply. This information can be used to develop contingency plans later in the GWPP process.

6.3 Step 3 - Contaminant Inventory

6.3.1 Methodology

A contaminant inventory was carried out to identify existing and potential sources of groundwater contamination within the Whitevale Subdivision and surrounding areas and determine their relevant risk to the Whitevale Well. The inventory was comprised of two components:

1. A regional inventory to identify general environmental concerns in the area; and
2. A preliminary contaminant inventory within the 60 day time-of-travel zone of the Whitevale Well.

The following is a summary of the information sources used to complete the regional and time-of-travel zone contaminant inventories:

1. Discussions with Mr. Bob Campbell, Infrastructure Services Manager, RDNO, regarding potential environmental concerns.
2. Discussions with Mr. Dale Thomas, Public Health Engineer, of IHA regarding health concerns in relation to water quality and groundwater use in Whitevale.
3. Search of the MOE Contaminated Sites Registry Database.
4. Review of 1:20,000 scale TRIM maps, 1:50,000 scale topographic maps, a 1:20,000 scale community map and 1:50,000 Agricultural Land Reserve Maps.
5. Review of available well logs for the Whitevale Area identified in the MOE Well Database.
6. Review of the Regional District of North Okanagan Official Community Plan for Electoral Areas D& E, Lumby Rural (May 2007),

7. Mapping available from BC Water Resource Atlas, iMap and Mineral Inventory mapping.
8. A site reconnaissance of the Whitevale Subdivision and surrounding area was conducted by Ms. Zee Marcolin of Golder on May 24, 2007.

6.3.2 Results of Regional Contaminant Inventory

The results of the regional contaminant inventory are presented below.

6.3.2.1 Search of MOE Contaminated Sites Registry

A search of the BC MOE Contaminated Site Registry Database (CSRSD) was conducted on October 23, 2007 to identify properties registered with the CSRSD located within 0.5 km of the Whitevale Well. The search found that there were no properties registered. The results of the CSRSD search is included in Appendix III.

It should be noted that the CSRSD contains information on contaminated sites-related documents and studies that MOE has acquired for specific properties since approximately 1989. The existence of a property within the CSRSD does not necessarily indicate that the property is contaminated as specified by the Contaminated Sites Regulation. The property registration process can also be triggered by other mechanisms such as property transactions and facility upgrades. Similarly, there may be contaminated sites within the Whitevale subdivision area and the surrounding area that have not been identified within the CSRSD.

6.3.2.2 Regional Mining Activity

The Mineral Activity Map available from the Ministry of Energy, Mines, and Petroleum Resources (<http://webmap.em.gov.bc.ca/mapplace/minpot/minEconomy.cfm#>) for the Whitevale area was reviewed and is provided in Appendix IV. No historic or current mining activities were identified in the Whitevale area. Mineral and placer claims were identified approximately 2 km to the south, along Harris Creek. No gravel extraction locations or tailing dumps were identified upgradient of the Whitevale Well.

6.3.2.3 Agricultural Issues

The Agricultural Land Reserve (ALR) map for the area (provided in Appendix V) indicates that the Whitevale subdivision is surrounded by land within the ALR. Agricultural land uses identified during the site reconnaissance included mainly crop cultivation or pasture in fields to the north, west, and east. Cattle were observed in the agricultural land immediately south of the Whitevale Subdivision, across Whitevale Road. It is uncertain whether the cattle reside in this area on a year round basis or if this area is used as an over-winter staging area.

Agriculture activity can be a potential source of groundwater contamination from bacteria, viruses, nitrites/nitrates, pesticides and fertilizers.

6.3.2.4 Septic and Sanitary Sewer Systems

According to Mr. Campbell, all homes in the Whitevale subdivision and in the surrounding areas are serviced by private septic systems.

Septic systems and dry pits on neighbouring properties were identified in previous work completed by Golder (Golder, 2005 & 2006) and are presented in Figure 2. The location of the neighbouring septic systems and dry pits dictated the chosen location of the Whitevale Well constructed in 2006, which was the only location at the 715 Franklin Road service lot that was situated at a distance greater than 30 m from potential contaminant sources as required in the BC Sanitary Regulations.

Septic systems can be a potential source of groundwater contamination, contributing bacteria, viruses, nitrates, detergents, oils, heavy metals, chemicals and other household contaminants disposed of by flushing or washing down a sink. Groundwater contamination in areas where septic systems are utilized may result if systems are poorly sited, designed, constructed, or maintained. In cases where the number or age of homes with septic systems increases, the capacity of the natural terrain to support the cumulative loading of septic effluent can create a concern. In such cases, the renovation of effluent prior to reaching groundwater can be insufficient resulting in groundwater contamination. Septic systems within the 60-day time-of-travel zones represent the greatest risk to water quality as there may be insufficient time for renovation of microbial contaminants.

6.3.2.5 Existing and Inactive Water Supply Wells

Thirty-three water wells were identified from the MOE Well Database in the study area. Four additional wells not registered in the MOE Well Database were identified over the course of the study through discussions with neighbours. There are likely more wells in the study area that are not registered in the MOE Well Database; however, identifying other private wells in the area was beyond the scope of this study. All known wells in the study area are provided in Figure 5.

The majority of these private wells are outside of the Whitevale Subdivision distribution system boundaries and therefore, most are assumed to still be in use. However, three inactive wells in close proximity to the Whitevale Well were identified during the survey; the Old Whitevale Well, one inactive well at 487 Whitevale Road and one inactive well three houses north of the Whitevale Well on Franklin Road. Of these, only the Old Whitevale Well is registered with the MOE database.

All of the wells identified in Figure 5, with the exception of the Whitevale Well, were constructed previous to the BC Groundwater Protection Regulation (GWPR) enacted in 2004. The GWPR requires that wells be constructed with an annular seal to ensure that surface contaminants do not have a migration pathway to the underlying aquifers through the annular space. Since all these wells were constructed previous to the GWPR, it is unknown if these wells have annular seals, as annular seals were construction only at the discretion of the driller and well designer before the GWPR was enacted.

Wells which are not properly sealed, poorly sited or have corroded casings can act as direct conduits for the migration of surface contaminants to the underlying aquifer(s). This is especially important for confined aquifers, which normally have a degree of protection from confining layers (or aquitards). In some extreme cases, inactive wells have been used for the disposal of wastes such as motor oil.

6.3.2.6 Stormwater Disposal

Stormwater is controlled within the Whitevale subdivision by ditches and drywells. Drainage from Whitevale Road is controlled by road side ditches, many of which have been filled in by the home owners. A number of dry wells on neighbouring sites were identified in an earlier study (Golder, 2005), although the total number in use in the study area is unknown. There are no reports of flooding from the Whitevale homeowners, nor is there evidence of ponding within the subdivision or along Whitevale Road. Therefore, most stormwater likely infiltrates relatively quickly to the shallow aquifer.

Stormwater runoff can contain contaminants such as oils, antifreeze and biological constituents which could potentially be transmitted directly to local aquifers by dry wells and infiltration basins. Stormwater can also reduce water quality of creeks and rivers.

Since the Whitevale Well is drawing water from a confined aquifer, water quality within the confined aquifer would likely not be impacted by local stormwater infiltration. However, this protection could be compromised should old or abandoned wells provide a migration route through the confining layer via an improperly constructed annular space or corroded well casing.

6.3.2.7 Surface Water Influences

Surface water degradation or contamination poses a risk to groundwater quality in the areas where the groundwater flow system is recharged by the rivers. In the pumping test completed at the construction of the Whitevale Well, a positive recharge boundary was identified approximately 200 m from the well. Based on the analysis of local well logs, the groundwater flow direction determined for the confined aquifer and time-of-travel analysis for the Whitevale Well, it is likely the positive recharge boundary is an inferred abandoned

channel of Bessette Creek and is likely hydraulically connected to Bessette Creek. The likelihood that groundwater at the Whitevale Well being impacted by surface water, specifically Bessette Creek is discussed in Section 6.3.3.1.

6.3.2.8 Landfilling

Leachate from landfills can contain a large range of contaminants, depending on the landfill contents. Typically, landfill leachate can impact pH, redox characteristics and dissolved oxygen demand and contains elevated concentrations of metals, dissolved solids, nutrients, and organic contaminants. Old landfills and illegal dump sites, where material restrictions are not enforced or those that are not constructed with liners, represent a particular concern.

No landfills were identified within the subject area, although there are local reports that a field approximately 400 m to the northeast of the Whitevale Well was historically used as an unofficial “dump”. There is also a transfer station located approximately 1.4 km northwest of the Whitevale subdivision along Dure Meadow Road. However, neither site is considered a risk to the Whitevale Well as they are both downgradient of the well and are relatively far from the 60-day time-of-travel zone.

6.3.2.9 Existing Land Use

The main land uses in the Whitevale Subdivision and surrounding area are residential and agricultural. Risks from residential land use are related to private chemical use and septic systems. Potential contaminants from common household sources included lawn care and garden chemicals (pesticides and fertilizers), common household products, and wastes related to property maintenance and automotive repair. Septic systems can contribute bacteria, viruses, nitrates, detergents, oils and other chemical contaminants to groundwater.

There is some local industrial land and gravel pits in the area as identified in the BC Water Well Atlas and iMapBC, which are located as follows:

- lumber yards, a sawmill and a burner located in an industrial area located approximately 1.5 km to the northwest,
- a gravel pit and abandoned pit located approximately 1.7 km to the southwest and two other pits located approximately 1.5 km to the south, and
- a burner and sawmill located close to Lumby, approximately 3 km to the northeast.

Appendix VI provides a map identifying these sites, however, they are considered too far in a downgradient or side-gradient direction to present a risk to the groundwater quality of the Whitevale Well.

6.3.3 Contaminant Inventory for the 60-Day Time of Travel Zone of the Whitevale Well

6.3.3.1 Preliminary GUDI Analysis

The Province of British Columbia does not have a formal regulation to evaluate whether groundwater is considered to be under the influence of surface water or “GUDI”. As such, the Ontario Ministry of Environment (OMOE) protocols were followed (OMOE, 2001). The Terms of Reference – *Hydrogeological Study to Examine Groundwater Sources Potentially Under Direct Influence of Surface Water* document states that community wells are “flagged” as potentially GUDI if they satisfy the following criteria:

- The wells regularly contain Total Coliforms and/or periodically contain E. coli; or
- The wells are located within approximately 50 days horizontal saturated travel time from surface water, or are within 100 m (overburden wells) or 500 m (bedrock wells) of surface water (whichever is greater) and meet one or more of the following criteria:
 - Wells may be drawing water from an unconfined aquifer;
 - Wells may be drawing water from formations within approximately 15 m of surface;
 - Wells are part of an enhanced recharge/infiltration project;
- When the well is pumped, water levels in surface water rapidly change or hydraulic gradients beside the surface water significantly increase in a downward direction;
- Chemical water quality parameters are more consistent with nearby surface water than local groundwater and/or if they fluctuate significantly and rapidly in response to climatological or surface water conditions.

No information is available concerning the response (if any) of surface water levels as a result of pumping groundwater from the Whitevale Well or about the chemical parameters of the adjacent surface water.

Based on the preliminary criteria above, the known hydrogeological properties of the aquifer, and the predicted 60-day time-of-travel zone, the Whitevale Well does not meet criteria that would flag it as potentially GUDI as the Whitevale Well:

- does not regularly contain Total Coliforms and/or periodically contain E. coli (Appendix VII provides the Bacterial Statistics for the Whitevale Well, supplied by Greater Vernon Services - Water), and
- is located at a distance greater than 100 m and at a travel time greater than 50 days from Bessette Creek, the closest surface water source to the Whitevale Well,
- is drawing water from a confined aquifer, and
- is drawing water from a formation that is greater than 15 m from the ground surface.

6.3.3.2 Surface Water Influences and Flooding

Surface water degradation or contamination of local creeks and streams could pose a risk to groundwater quality if the Whitevale Well was identified to be GUDI. As discussed in Section 6.3.3.1, the Whitevale Well does not meet the criteria to be flagged as potentially GUDI.

Wells could also be vulnerable to surface water contamination from flooding if they are not properly cased and/or sealed. The 200-year floodplain levels of major river systems in B.C. have been mapped and the available floodplain map for Bessette Creek close to Whitevale is provided in Appendix VIII. According to this floodplain map, the Whitevale Well is located above the 200-year floodplain level and therefore not at risk of flooding from Bessette Creek.

Also, the Whitevale Well was constructed in 2006 and meets GWPR (MOE, 2004) standards. The well was completed with an annular seal that was grouted from ground surface to a depth of 7.1 mbgs. The annular seal extends a minimum of 2 m into the confining layer above the aquifer, which will inhibit contaminants from migrating from the upper aquifer or ground surface to the confined aquifer via the annular space. However, the Old Well is within the 60-day time-of-travel zone (Figure 6) and does not have a proper annular seal. This well could provide a migration route for contaminants from the surface through the confining layer and could negatively impact water quality of the Whitevale Well.

6.3.4 Land Use within Capture Zones

A preliminary contaminant inventory within the 60-day time-of-travel zone and associated buffer area for Whitevale Well was conducted by means of field reconnaissance, an office review of available information and interviews with a limited number of residents and representatives of RDOS and IHA. The inventory did not include interviews with private property owners, site-specific inspections, or a review of historical site activities other than that provided in the CSRD.

It should be noted that the 60-day time-of-travel zone represents a preliminary calculation and could be subject to change as additional information becomes available or conditions change. Although it provides a reasonable estimation for the purposes of this study, potential contaminants located close to the Whitevale Well but outside the 60-day time-of-travel zone and associated buffer area should also be considered as seasonal changes in hydrogeologic conditions could impact the time-of-travel zone boundaries.

The following provides an inventory of land-use within or close to the preliminary 60-day time-of-travel zone and associated buffer zone that represent a risk to groundwater quality, which are also provided in Figure 7:

- There are at least five residential properties located within the 60-day time-of-travel zone, with another eight properties within the buffer zone that likely utilize septic systems. The 60-day travel-of-time zone for groundwater is generally accepted as the time required for the renovation of biological pathogens in groundwater and septic systems within the 60-day travel-of-time zone may not provide sufficient renovation of pathogens. Potential contaminants from septic systems include bacteria, viruses, nitrates, detergents, oils, heavy metals, chemicals and other household contaminants disposed of by flushing or washing down a sink.
- Residential housing within the 60-day travel-of-time zone can also potentially introduce pesticides, fertilizers, oils, fuels, automotive fluids and other chemical contaminants to the groundwater.
- The agricultural pasture to the south of the Whitevale Well and within the 60-day travel-of-time zone was occupied by a high-density of cattle in November 2007. Contaminants of concern from high-density feedlots or from other domestic animals include nitrates, nitrites, ammonia, bacteria, viruses and other pathogens. Agricultural land used for crop cultivation can introduce pesticides and fertilizers into the groundwater.
- The Old Well that was used to supply the community water for Whitevale is within the 60-day time-of-travel zone and very close to the current Whitevale Well. This well is constructed in the confined aquifer and it is suspected that it was not constructed with a surface annular seal or a seal between the shallow aquifer and confined aquifer. Evidence to support this is related to an incident where the sampling tap in the pump house was accidentally left on and the concrete slab around the pump house was flooded (Mr. Campbell, pers. comm., 2006). This resulted in bacterial counts within the well water when historically the well produced consistent bacterial results of 0 colonies/100 ml.
- There were four wells located in the Whitevale Subdivision that were not identified in the MOE Well Database during the course of this study. It is suspected that there are likely

other wells in the area not currently identified in the MOE Well Database. Inactive and old wells present a high risk as they can provide a direct conduit for contaminants to underlying aquifers. This is especially important for the Whitevale Well as the natural protective properties of the confining layer could be compromised.

- Whitevale Road crosses through the 60-day travel-of-time zone of the Whitevale Well. Although Whitevale Road is not considered a major transportation route, road salt is likely applied in the winter months and road drainage is directed to swales adjacent to the road, which may act as infiltration areas. Road salt can negatively affect water quality by increasing the sodium and chloride content in groundwater. Roads also increase the risk of contamination to local aquifers from spills and accidents releasing automotive fluids and other contaminants, however the risk is typically less on minor roads.
- The proposed abandoned channel of Bessette Creek is at the outer boundary of the 60-day time-of-travel zone and may be the recharge area for the Whitevale Well. Since the channel is at the outer boundary of the 60-day time-of-travel zone, there may be sufficient renovation time for microbial contaminants, which is supported by the historical well monitoring results. However, the inferred abandoned channel may traverse through residential properties and agricultural fields. As this area is unconfined, it is more vulnerable to surface contamination and chemical inputs in this area of could impact the water quality in the confined aquifer.

Most of the contaminant risks within the 60-day time-of-travel zone and buffer area described above have a greater risk of impacting the water quality of the shallow aquifer. The water quality of the confined aquifer has a measure of protection due to the low permeability of the confining layer and the vertical upward pressure displayed in the aquifer as demonstrated by the static water levels measured in the aquifer. However, old or abandoned wells could provide a migration route from the shallow aquifer to the confined aquifer through inadequate annular seals or corroded casing.

There is also a possibility that the groundwater flow direction in the shallow well is not the same as that found in the confined aquifer, which may alter the time-of-travel zone of the Whitevale Well. For example, if the shallow aquifer groundwater flow direction is opposite that of the confined aquifer (i.e. to the south towards Bessette Creek), then land use activities on properties to the north of the Whitevale Well may become a risk to the water quality in the confined aquifer, especially as there is a potential migration route through the annular space in the Old Well and other old or inactive wells in the area.

7.0 PRELIMINARY RISK ASSESSMENT OF WATER QUALITY THREATS

Based on the contaminant inventory results outlined in Section 6.3.4, a preliminary risk assessment was completed to assist in the relative ranking of each potential threat identified. The risk assessment can be useful for prioritization of action items.

The results of the risk assessment are provided in Table 1 and were based on the following criteria:

$$\text{CONSEQUENCE} \times \text{PROBABILITY} = \text{RISK}$$

Where:

Probability (of Occurrence ¹ and Exposure ²)	
1	Rare or unlikely occurrence with minimal risk that contaminant will migrate to confined aquifer.
2	Possible occurrence with no known migration risk to the confined aquifer
3	Possible occurrence with high risk of migration to the confined aquifer
4	Certain occurrence with no known migration risk to the confined aquifer
5	Certain occurrence with high risk of migration to the confined aquifer

1. Occurrence is based on the assumption that the hazard occurs in the 60-day time-of-travel zone or buffer area. Hazards that occur outside the buffer area are assume to have a zero consequence upon the Whitevale Well and are therefore not considered.
2. Exposure is related to the potential risk that contaminants can migrate through the confining layer or within an unconfined portion of the aquifer.

Consequence of Exposure	
1	Slight Effect. Small change in water quality.
2	Moderate Effect. Moderate change in water quality requiring mitigation (treatment of water supply).
3	Major Effect. Significant change in water quality that cannot be mitigated by treatment or potentially causing acute health concerns.

Notes: 1. Adapted from Golder, 2004b and Schillereff et. al, 2005.

2. The ranking of potential consequences is based on an estimate of potential responses to assist in prioritizing future action. Potential consequences are based on generalized, hypothetical scenarios. Actual consequences will depend on site-specific conditions.

The following risk matrix was used to rank and prioritize risks for the risk assessment:

Probability	5	5	10	15
	4	4	8	12
	3	3	6	9
	2	2	4	6
	1	1	2	3
		1	2	3
		Consequence		

Where: Consequence × Probability = Risk

And the risk levels are:

- Low: 1 - 2
- Moderate: 3 - 6
- High: 7 - 9
- Very High: 10 - 15

Risk matrices can have more variability and a larger range of risk levels can be assigned if more time-of-travel periods are delineated. The risk matrix for this Study is relatively simple as only the 60-day time-of-travel zone (and buffer area) was calculated. Although the risk assessment is simplified, it is considered an appropriate way of ranking and prioritizing the hazards for the current objectives of this Study.

The results of the preliminary risk assessment for the threats identified in the contaminant inventory are summarized in Table 1. The results indicate that the known inactive wells, including the Old Well, present the highest risk to the water quality of the confined aquifer and are ranked a very high priority. This is because old and abandoned wells can provide migration routes from the ground surface or from the shallow unconfined aquifer to the lower confined aquifer. The septic systems within the 60-day capture zones and the high density feedlot (or over-wintering pasture) are also ranked as having a high priority due to their potential for contributing microbial contaminants to the groundwater.

The inferred abandoned channel of Bessette Creek has a high priority ranking because it appears to be unconfined and a potential recharge area of the confined aquifer. There is a risk that chemicals spilled or applied in this area can directly impact the water quality of the confined aquifer. Suspected inactive wells also have a high priority ranking based on the reasoning provided above.

Agricultural land practices, spills from road accidents, use of road salt and residential practices all have a moderate priority rating. This is mainly due to the uncertainty of occurrence, together with the protection provided by the confining layer.

The risk assessment completed in this report is cursory only, based on the preliminary contaminant inventory, and does not identify specific threats. For example, the assessment identifies the potential hazard of domestic septic systems; however it does not identify the locations of each septic system and the risks associated with the age, condition and distance from abandoned or old wells. Specific threats may be incorporated into the risk assessment table as they are identified in later stages of the GWPP (for example, should a more detailed

contaminant inventory be completed). The risk assessment tables can also be expanded at a later date for planning and implementation of groundwater protection measures.

8.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the results of this initial phase of development of a GWPP for Whitevale, the following conclusions are made:

- The Whitevale Well supplies all residential water requirements for approximately 100 residential lots that are connected to the Whitevale water distribution system.
- The Whitevale Well draws water from a confined aquifer, identified in the MOE Aquifer Classification System as Aquifer No. 317 and classified as moderately utilized with a low vulnerability to contamination.
- The Whitevale Well was constructed in 2006 in accordance to GWPR standards and has a surface annular seal that extends at least 2 m into the confining layer of the aquifer.
- The lateral extents of Aquifer No. 317 are the mountain slopes to the north and south of Whitevale, Aquifer No. 352 to the west and Aquifers No. 318 and 319 to the east. Although the top of the aquifer is identified a the till/clay confining layer at a depth between 12 m below ground surface (bgs) and 21 m bgs, there are no well logs in the MOE database that are deep enough to identify the bottom of the confined aquifer.
- An examination of MOE well logs identified three wells between Bessette Creek and the Whitevale Well where a confining layer was not encountered above Aquifer No. 317, indicating the possible presence of an abandoned channel containing sand and gravel in this area. The inferred abandoned channel is likely hydraulically connected to Bessette Creek and likely acts as the recharge area for the Whitevale Well.
- An elevation and location survey was completed on four wells and the static water levels measured, which provided a groundwater flow direction in the confined aquifer to the northwest, towards Duteau Creek. The localized hydraulic gradient was calculated to be approximately 0.016 m/m. The groundwater flow direction in the shallow, unconfined aquifer is unknown.
- A water balance calculation for the Bessette Creek catchment area to the Whitevale Well provided an annual aquifer recharge estimate of 1.3×10^7 m³/year, annual extraction range of 6.9×10^5 m³/yr to 8.7×10^5 m³/yr and an annual net surplus of 1.2×10^7 m³/yr. The utilization rate calculated was approximately 6%. (Note this calculation is for all aquifers in the unconsolidated valley bottom materials. There is

insufficient information to complete a water balance solely for the confined aquifer).

- The preliminary 60-day time-of-travel zone of the Whitevale Well was estimated using an analytical equation method based on known aquifer parameters and the maximum recommended pumping rate for the Whitevale Well. Longer time-of-travel zones (for example, 1-year time of travel) were not calculated because the 60-day time-of-travel zone intersected a positive recharge boundary. As the 60-day time-of-travel zone is strongly influenced by the groundwater flow direction and hydraulic gradient, a buffer area around the 60-day time-of-travel zone was also estimated to compensate for potential seasonal fluctuations in groundwater conditions.
- The southern boundary of the 60-day time-of-travel zone intersected an inferred abandoned channel of Bessette Creek, located at approximately 175 m south of the Whitevale Well. This corresponds to the positive recharge boundary identified approximately 200 m from the Whitevale Well based on the results of the pumping test completed at the time of construction.
- A preliminary Groundwater Under the Direct Influence of surface water (GUDI) assessment indicated that the Whitevale Well does not meet criteria that would flag the well as potentially GUDI.
- The contaminant inventory indicated residential and agricultural land uses within the 60-day time-of-travel zones of the Whitevale Well.
- Inactive or old wells, including the Old Well, domestic septic systems and a neighbouring high density feed lot (or over-wintering pasture) are considered very high priority in regards to the risk of contamination to the Whitevale Well.
- The inferred abandoned channel of Bessette Creek and suspected inactive wells within the 60-day time-of-travel zone and buffer area are considered to represent a high priority contaminant risk to the Whitevale Well.
- Moderate priority contaminant risks to the Whitevale Well were identified as agricultural land used to grow crops, potential spills from accidents on the roads, use of road salt and residential land use.

The following nine recommendations are made in regards to further assessing the water quality risks to the Whitevale Well from the surrounding land use and to refine the areas that could potentially impact the water quality:

1. Determine the Groundwater Flow Direction of the Shallow Aquifer

Due to the uncertainty of the influence of the shallow aquifer on the 60-day time-of-travel zone of the Whitevale Well, the groundwater flow direction of the shallow aquifer should be assessed. Although it may not change the 60-day time-of-travel zone identified for the Whitevale Well, since this is calculated for the source aquifer, this information will assist in refining the buffer area around the 60-day time-of-travel zone to the Whitevale Well and in guiding the recommendations that follow.

2. Neighbourhood Survey and Education Program

Since inactive and old wells present a high risk to the water quality in the confined aquifer, a door-to-door survey should be undertaken of all properties in the 60-day time-of-travel zone and buffer area to identify all water wells. Each well should be visually inspected and the following should be documented:

- ⇒ the well location (with GPS coordinates if possible) and surrounding land-use,
- ⇒ exterior condition of well should be photo-documented with comments on the well cap, pump house, condition of well casing above ground, and potential for ponding at the ground surface,
- ⇒ well depth and static water level,
- ⇒ age of well and current use, and
- ⇒ collecting well logs from residents if not provided in MOE Well Database (if available).

Once this information is collected, the risk that each well presents to water quality in the confined aquifer can be assessed. A management strategy for each well can then be developed that details any work required and a timeline. Further work that may be required may include increased monitoring, improvements to the well cap, surface seal, videotaping the well to check the well condition or well decommissioning. Timelines should be dictated by the risk the well presents to the water quality of Aquifer 317.

If a door-to-door survey is conducted, this opportunity should also be utilized to provide public education and to gather more comprehensive information about potential water quality risks, by:

- ⇒ collecting information about the types and quantities of chemicals used,
- ⇒ identifying septic tank and field locations,

- ⇒ identifying dry wells and the existence of road-side ditches and their drainage patterns,
- ⇒ providing information to property owners about the risk of their on-site activities to the local groundwater quality and to their own drinking water, and
- ⇒ providing best management practices in relation to reducing their impacts to the local groundwater.

3. Aquifer Monitoring

The residential septic systems and cattle feed lot present a high risk to local groundwater quality. Potential migration routes of associated contaminants to the confined aquifer are through old or inactive wells and infiltration in the unconfined area of the aquifer (i.e. the recharge area represented by the inferred abandoned channel). A limited groundwater monitoring program is recommended to provide early warning of impending water quality problems at the Whitevale Well. This program would focus on monitoring of water quality in the shallow aquifer and in the potential recharge area of the deeper aquifer.

Some suggestions for the development of a monitoring program are as follows:

- ⇒ Utilizing one or two existing wells completed in the shallow aquifer to sample and analyze for parameters related to septic fields, road salt and cattle operations (i.e. sodium, chloride, phosphorus, ammonia, nitrate/nitrite, metals, Total Coliform and E. Coli). Wells completed in the shallow aquifer that might be candidates for sampling are WTN # 8475, 3270 and the private well located at 495 Whitevale Road (not identified within the MOE Well Database).
- ⇒ Utilizing one or two of the existing wells completed in the potential recharge zone of the Whitevale Well to test for parameters related to septic fields and cattle operations (i.e. phosphorus, ammonia, nitrate/nitrite, metals, Total Coliform and E. Coli). Wells completed in the potential recharge zone of the Whitevale Well that might be candidates for sampling are WTN # 57246, 41504 and 58436.
- ⇒ The parameters outlined above should be re-examined to include relevant information obtained from the door-to-door surveys. For example, if it is discovered during the door-to-door surveys that a particular property has an oil storage tank of questionable condition, then parameters relating to heavy petroleum hydrocarbons may be recommended in the sampling plan.

⇒ the suggested monitoring frequency of sampling is quarterly for two years. The results can then be reviewed to assess if more or less monitoring is required.

⇒ Samples collected should be submitted to a *Canadian Association for Environmental Analytical Laboratories* (CAEAL) certified laboratory for analysis.

4. Developing an Action Plan for the Old Well

The Old Well at the Whitevale service lot is within the 60-day time-of-travel zone and likely does not have an annular seal to prevent the migration of contaminants from the shallow aquifer to the confined aquifer. This presents a risk to the water quality in the Whitevale Well. However, the Old Well may be useful as a monitoring well, an emergency back up well or for a short-term supply well in the future when rehabilitation of the Whitevale Well is required.

Since there are both advantages and disadvantages to keeping the Old Well operable but inactive, the value of the Old Well to RDNO should be assessed and an action plan formulated. This assessment should be carried out once additional information related to groundwater flow (Recommendation #1) and groundwater quality monitoring (Recommendation #3) becomes available. At this time, there are potentially three options that could be examined:

Option 1 – the Old Well is decommissioned according to the GWPR code of practice to ensure contaminants can not migrate from the shallow aquifer to the confined aquifer via the well casing or annular seal. This scenario would be recommended if the monitoring program indicates that the shallow aquifer has a high level of contaminant loading from surrounding land-use activities.

Option 2 - the Old Well is left inactive but in an operable state and included in the emergency response and contingency planning as a backup well. This option would only be considered if the contaminant loading in the shallow aquifer does not represent a risk to the confined aquifer.

Option 3 - the Old Well is upgraded by installing a surface annular seal and left inactive but in an operable state and included in the emergency response plan as a backup well. This option would be considered if it was determined that the Old Well has considerable value as a back-up well but the contaminant loading in the shallow aquifer and risks from surrounding land-use is too great to leave in it's original state. According to the construction details of the Whitevale Well, the aquitard layer starts at about 1.8 mbgs and therefore an annular surface seal would need to penetrate into this layer.

5. Monitor Performance of Whitevale Well

In addition to the static and pumping water levels that the RDNO currently monitors at the Whitevale Well, it is recommended that pumping rates and the duration of pumping be recorded on a monthly basis to assess well performance. It is also recommended that water levels in the Old Well continue to be monitored (unless it is decommissioned). This information should then be reviewed annually by a qualified professional to assess well efficiency, and potentially identify early indications of well deterioration.

6. Designate Groundwater Protection Areas

Following refinement of the buffer area based on the groundwater flow direction of the shallow aquifer, the RDNO should designate formal groundwater protection areas. Two different strategies can be employed when designating groundwater protection areas: i) a wellhead protection approach, whereby groundwater protection area is defined relative to a designated time-of-travel zone or, ii) an aquifer protection approach, whereby part or all of an aquifer is designated for protection. For example, the RDNO may wish to consider designating the potentially unconfined (recharge) area of the Aquifer No. 317 as a groundwater protection area.

The RDNO may also wish to identify one or more contingency areas for protection in the event that the Whitevale Well becomes contaminated. The advantage of defining protection areas in this manner is that it allows for the protection of groundwater recharge areas, surface water quality, areas serviced by private water wells and areas where future water supplies may be developed.

7. Develop Groundwater Protection Measures

Once designated groundwater protection areas have been established and additional potential contaminant sources have been identified, RDNO should embark on the development of groundwater protection measures. Groundwater protection measures can be implemented at the municipal level through both regulatory and non-regulatory measures. In our opinion, while non-regulatory measures, such as public education and best management practices, can be highly effective, some degree of regulatory control may be required to ensure the protection of the groundwater resources.

These regulatory strategies often involve the use of municipal land use planning and zoning bylaws to restrict certain high-risk land use activities within protection areas. As an alternative to land use restrictions, some communities, such as Fredericton, New Brunswick, have chosen to restrict the types and quantities of chemicals used within groundwater protection areas.

RDNO may want to initiate discussions with the owner of the cattle feed lot and other agricultural land owners within the 60-day time of travel capture zone of the Whitevale Well regarding protection measures. Discussions should focus on possible alternative locations to over winter cattle, or at a minimum, restricting cattle from the recharge area of the Whitevale Well and about types of chemical uses within this area that pose a risk to groundwater quality and whether legal restrictions are required.

Public participation and education represents one of the most important forms of non-regulatory groundwater protection. It is essential to the success of a groundwater protection plan and provides a means of securing political and financial support. A public education campaign would identify groundwater protection areas, threats to groundwater supplies in those areas, and measures residents can take to protect the resource. Examples of public education tools include the use of the public information meetings, signs erected at strategic locations around groundwater protection areas, the use of media, distribution of information brochures on best management practices and school education programs.

In addition, the following recommendations are made regarding groundwater protection measures:

- Prepare an educational brochure or pamphlet aimed at all of Whitevale and the surrounding area residents for:
 - The proper application of fertilizers and pesticides (with an emphasis away from utilization of pesticides and chemical fertilizers).
 - The importance of good handling and disposal practices of household chemicals and the potential impact of these chemicals on the groundwater quality in Whitevale.
 - Best management practices for the operation and maintenance of septic tanks and effluent disposal fields.
 - The potential impacts of stormwater runoff.
- RDNO may also want to consider restrictions for pesticide and fertilizer use in sensitive areas, with no-spray zones around water supply wells. In addition, contingency plans should be prepared in the event of a pesticide or fertilizer spill or accident. Mixing of chemicals and refilling of containers, spray and applicators should be completed in contained areas away from wells, water sources, and areas characterized by permeable soil conditions.

8. Update Emergency Response Plans

The main goal of GWPPs is to prevent the contamination of underground drinking water supplies. Even under the best prevention plans, a scenario that threatens to contaminate the

aquifer may occur. When this happens, emergency response plans direct a coordinated and timely response to assure a continued supply of potable water. Many communities have an emergency response plan, however they often do not include specific provisions for the protection of groundwater resources in the event many emergency situations. For example, it may be prudent for emergency response personnel to restrict the use of fire retardant chemicals in sensitive groundwater areas.

RDNO currently has an Emergency Response Plan for the Whitevale water supply, however it requires revision and may not include all possible hazards as identified in this Study. We recommend that RDNO update and revise the emergency response plan for the Whitevale Well.

9. Develop Contingency Plans

Contingency planning consists of developing a plan for the location and provision of an alternative drinking water supply in the event that the existing supply cannot be used. This is important for the Whitevale Subdivision as they only have one well supplying all their water. It is recommended a contingency plan be developed for the Whitevale Subdivision. The contingency plan should identify short-term alternatives in the event of a minor disruption, and long-term alternatives in the event of a complete loss of water supply.

9.0 LIMITATIONS AND USE OF REPORT

This report was prepared for the exclusive use of the Regional District of North Okanagan. In evaluating the requirements for groundwater protection, Golder Associates Ltd. has relied in good faith on information provided by sources noted in this report. We accept no responsibility for any deficiency, misstatements or inaccuracy contained in this report as a result of omissions, misstatements or fraudulent acts of others.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Golder Associates Ltd. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

10.0 CLOSURE

We trust that this report meets your current requirements. Should you have any questions or comments please do not hesitate to call.

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ZM/cfh

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REFERENCES

British Columbia Health Act - Sanitary Regulations [includes amendments up to B.C. Reg. 266/96] Section 42

Campbell, Bob. 2006. Personal Communication. Infrastructure Services Manager, RDNO.

Ceric, A. and Haitjema, H. 2005. On Using Simple Time-of-Travel Capture Zone Delineation Methods. *Groundwater*. Volume 43, No. 3, pp 408-412

Fetter, C.W. 2001. *Applied Hydrogeology*. Fourth Edition. Prentice Hall. New Jersey.

Freeze, R.A., and J.A. Cherry. 1979. *Groundwater*. Prentice-Hall Inc. Englewood Cliffs, New Jersey. 07632.

Golder Associates Ltd. (Golder). 2003. Phase 1 Groundwater Protection Planning, Keremeos, B.C.

Golder Associates Ltd. (Golder). 2004. Model Environmental Management System for the City of Kelowna.

Golder Associates Ltd. (Golder). 2005. Preliminary Hydrogeological Assessment, Whitevale Subdivision, 715 Franklin Road, Whitevale, B.C. (project # 05-1440-067)

Golder Associates Ltd. (Golder). 2006. Hydrogeological Services for Design, Construction and Yield Testing of the New Community Well for Whitevale, B.C. (project # 06-1440-022)

Matthess, G., S.S.D. Foster and A.Ch. Skinner, 1985. Theoretical Background, Hydrogeology, and Practice of Groundwater Protection Zones; Internal Publication, Volume 6, International Association of Hydrogeologists.

Ministry of Agriculture, Food and Fisheries (MAFF). February 2001. "Guide to Irrigation System Design with Reclaimed Water", an Irrigation Fact sheet.

Ministry of Environment, Lands and Parks and the Ministry of Health. 2000. Well Protection Toolkit.

Ministry of Health Services (MHS). 2005. Sewerage System Standard Practice Manual. Victoria, BC

Ontario Ministry of Environment (OMOE). 2001. Terms of Reference – Hydrogeological Study to Examine Groundwater Sources Potentially Under Direct Influence of Surface Water. A Guideline Document for the Ontario Drinking Water Protection Regulation. 6 pages.

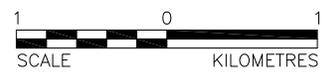
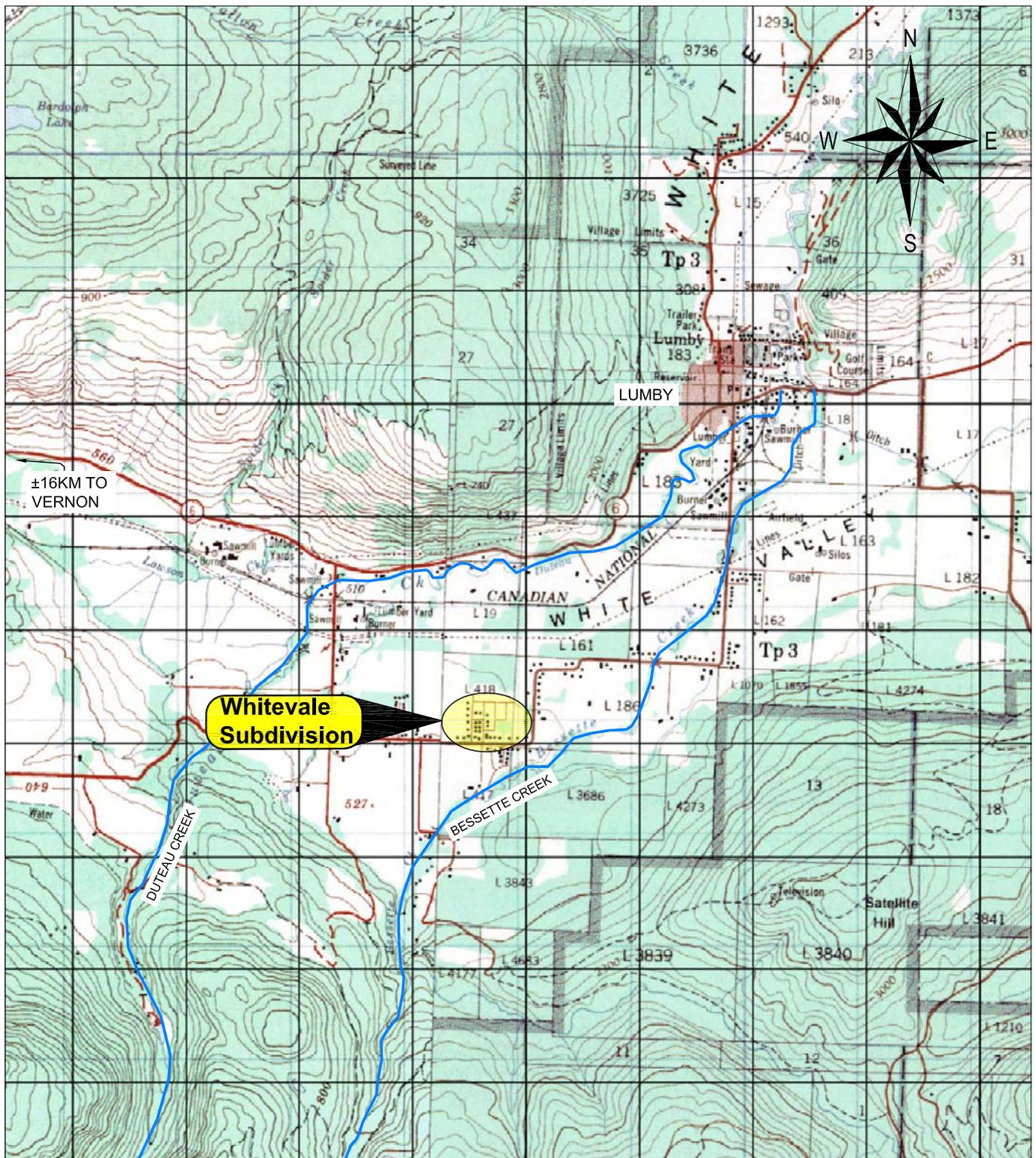
Schillereff, H.S., G. Wendling, and T. Gleeson. 2005. Risk-Based Wellhead Protection Planning. Paper presented at Canadian Water Resource Association conference in Kelowna, February 23, 2005.

Wood, W.W., and Sanford, W.E. 1995. Chemical and Isotopic Methods for Quantifying Groundwater Recharge in a Regional, Semi-Arid Environment. *Ground Water*, 33(3), pp. 458-468.

Table 1 - Preliminary Risk Assessment for the Whitevale Well

Hazard	Probability	Consequence	Risk Prioritization	Risk Ranking
Known Inactive Wells	5	3	15	Very High
Domestic Septic Systems	4	3	12	Very High
High Density Feedlots	4	3	12	Very High
Abandoned Channel	3	3	9	High
Suspected Inactive Wells	3	3	9	High
Spills from Road Accidents	2	3	6	Moderate
Residential	2	2	4	Moderate

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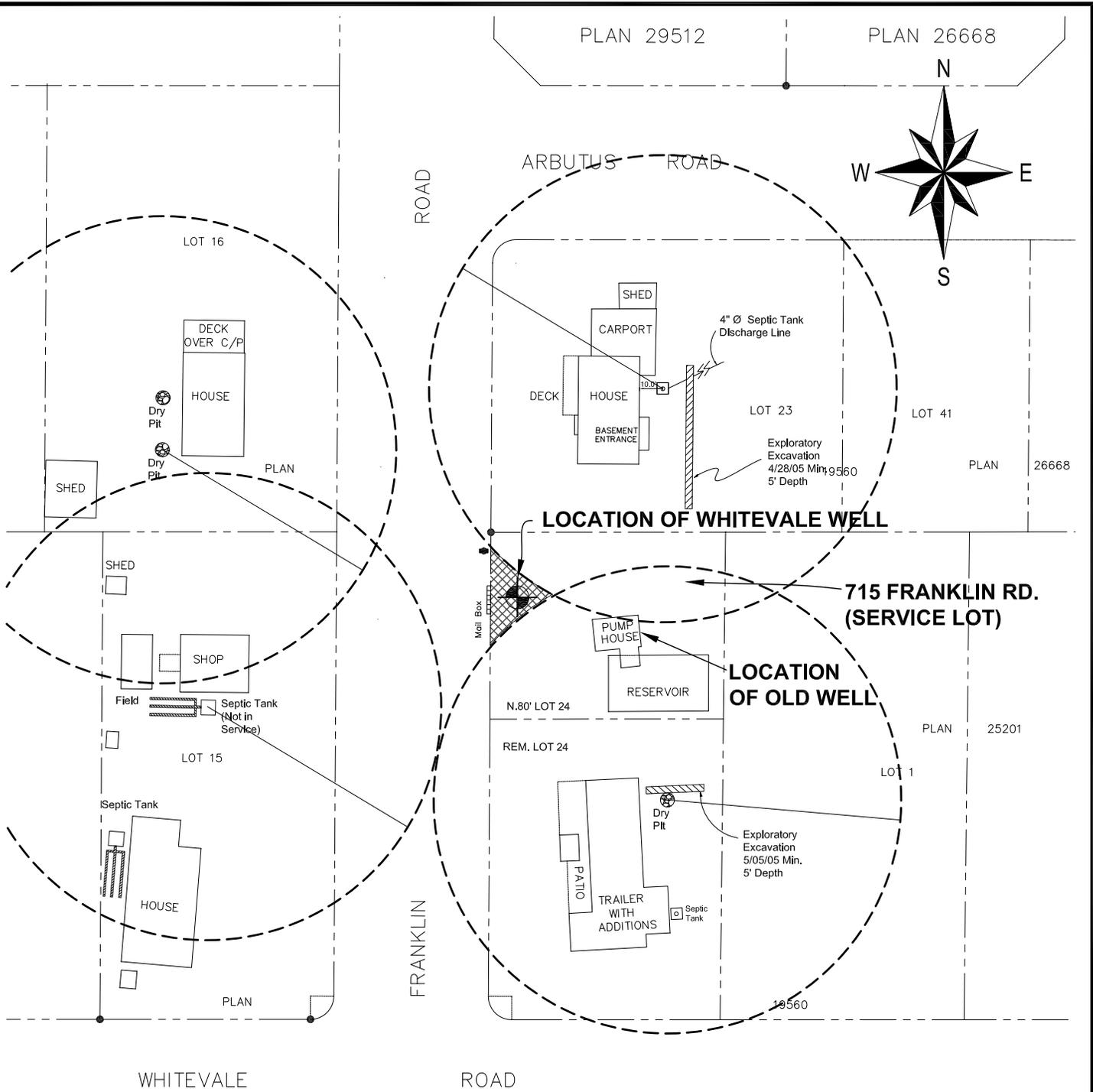


REFERENCES

1.) COORDINATE REFERENCE: UTM ZONE 11n, NAD83
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TITLE	KEY PLAN			
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	CHECK			
REVIEW				
				FIGURE: 1

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LEGEND

-  30.48m RADIUS AROUND POTENTIAL CONTAMINANT SOURCE
-  AREA ON PROPERTY GREATER THAN 30.48m (100') FROM ALL NEIGHBOURING DRY PITS, SEPTIC TANKS OR FIELDS

REFERENCES

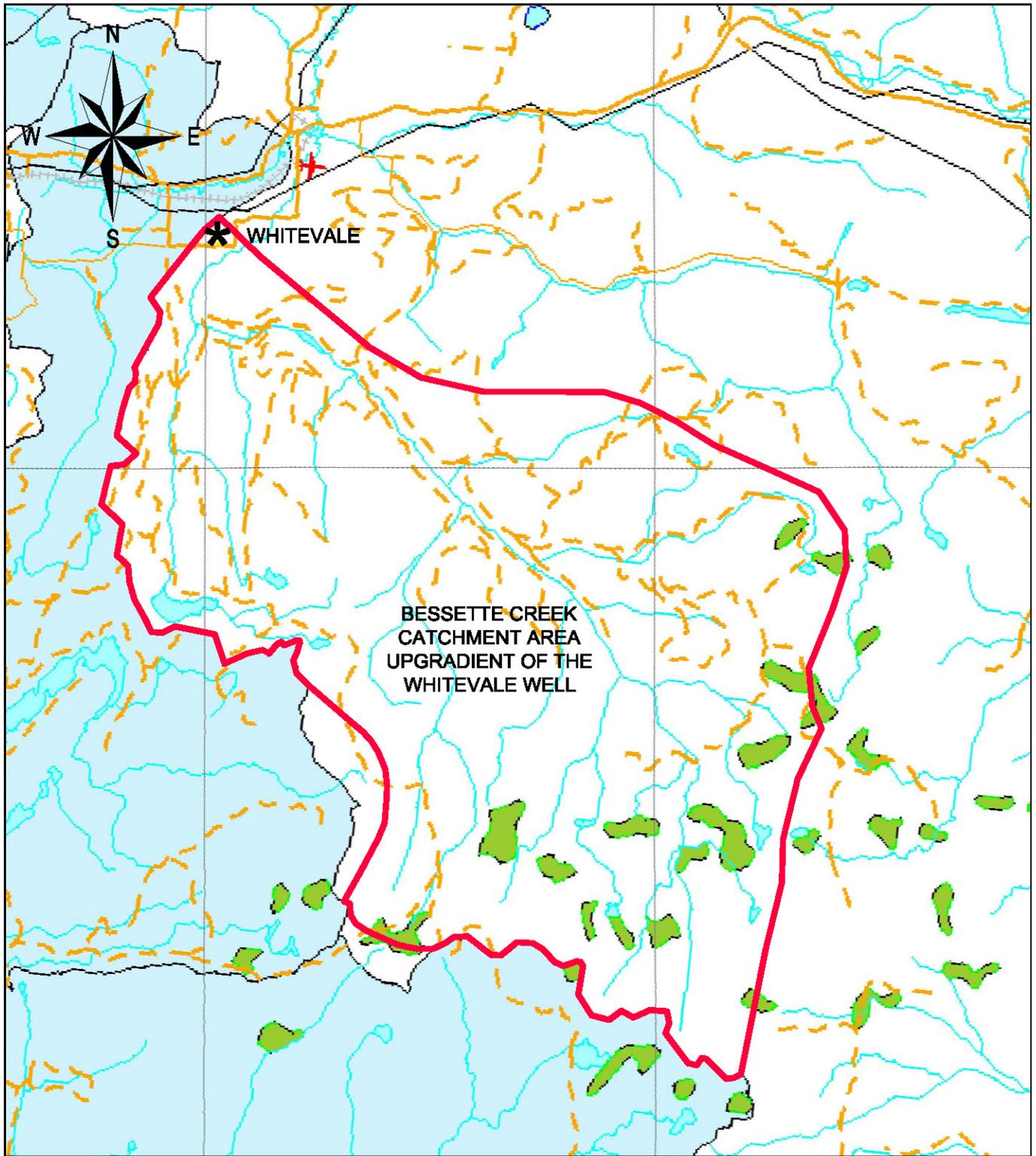
1.) RUSSEL N. SHORT, B.C. LAND SURVEYOR, FILE# 23958
 F.B.#1065 Pg. 60, DATED: APRIL 6, 2005.

PROJECT **GROUNDWATER PROTECTION PLAN
 NORTH OKANAGAN REGIONAL DISTRICT
 WHITEVALE, B.C.**

TITLE **LOCATION OF WHITEVALE WELL**

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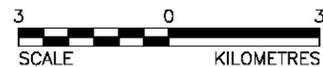


LEGEND

- BESSETTE CREEK WATERSHED BOUNDARY TO WHITEVALE WELL
- - - LOGGING ROADS

REFERENCES

- 1.) MAP OBTAINED FROM BC WATER RESOURCES ATLAS (2008).

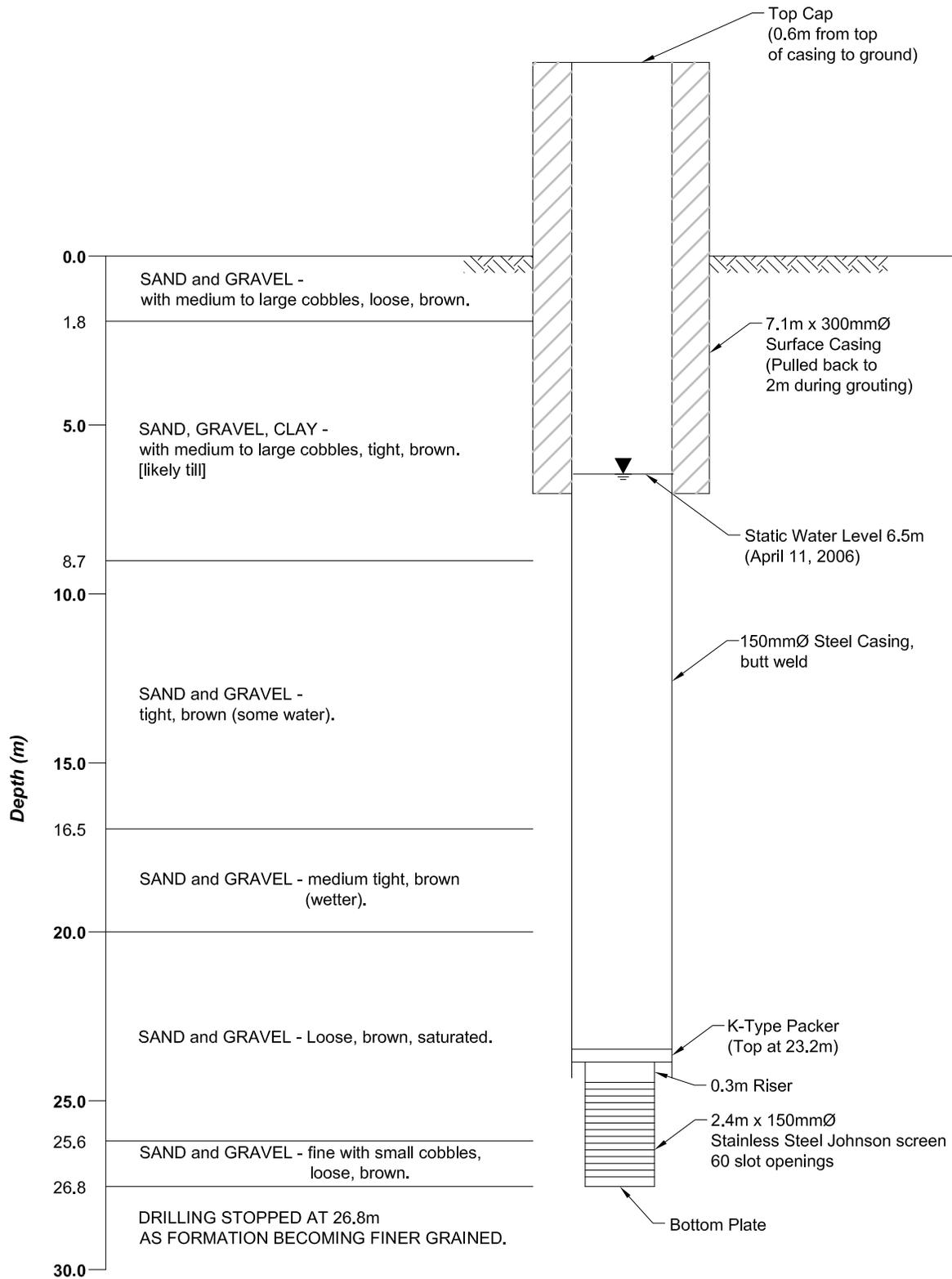


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REVIEW			

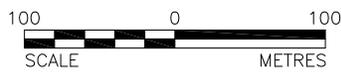
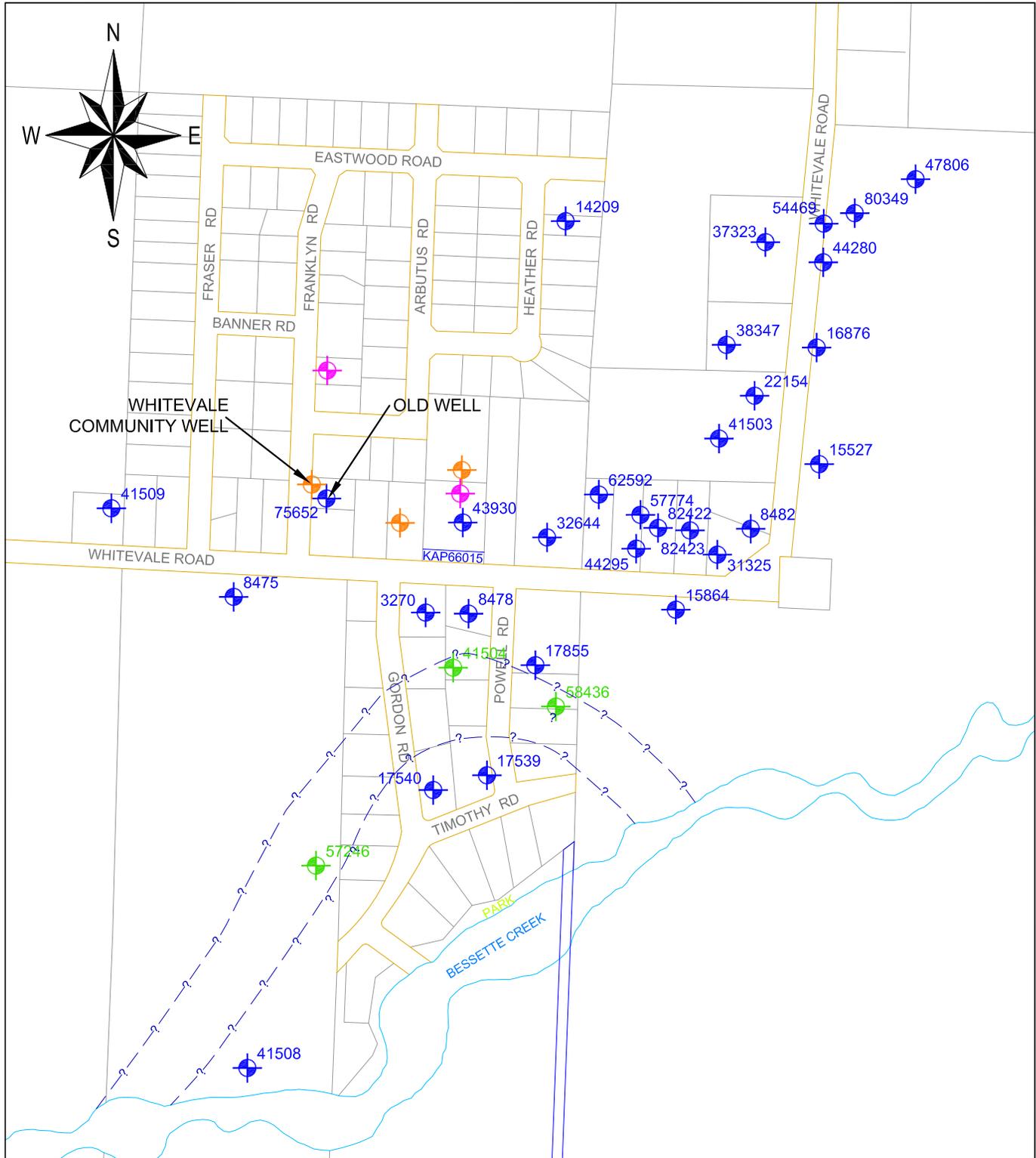


FIGURE: 3

N:\Active\2007\1440 - Kelowna\07-1440-0089 Whitevale\Drafting\Task 2000\CAD\CAD\Drawing file: 0714400089_2000_4.dwg May 06, 2008 - 2:30pm



PROJECT		GROUNDWATER PROTECTION PLAN NORTH OKANAGAN REGIONAL DISTRICT WHITEVALE, B.C.			
TITLE		WELL LOG & CONSTRUCTION DETAILS OF THE WHITEVALE WELL			
PROJECT No. 07-1440-0089(2000)		FILE No. 0714400089_2000_4.dwg			
DESIGN	ZM	01/NOV/07	SCALE	NTS	REV. 0
CADD	SWD	06/DEC/07			
CHECK					
REVIEW					
			FIGURE: 4		



LEGEND

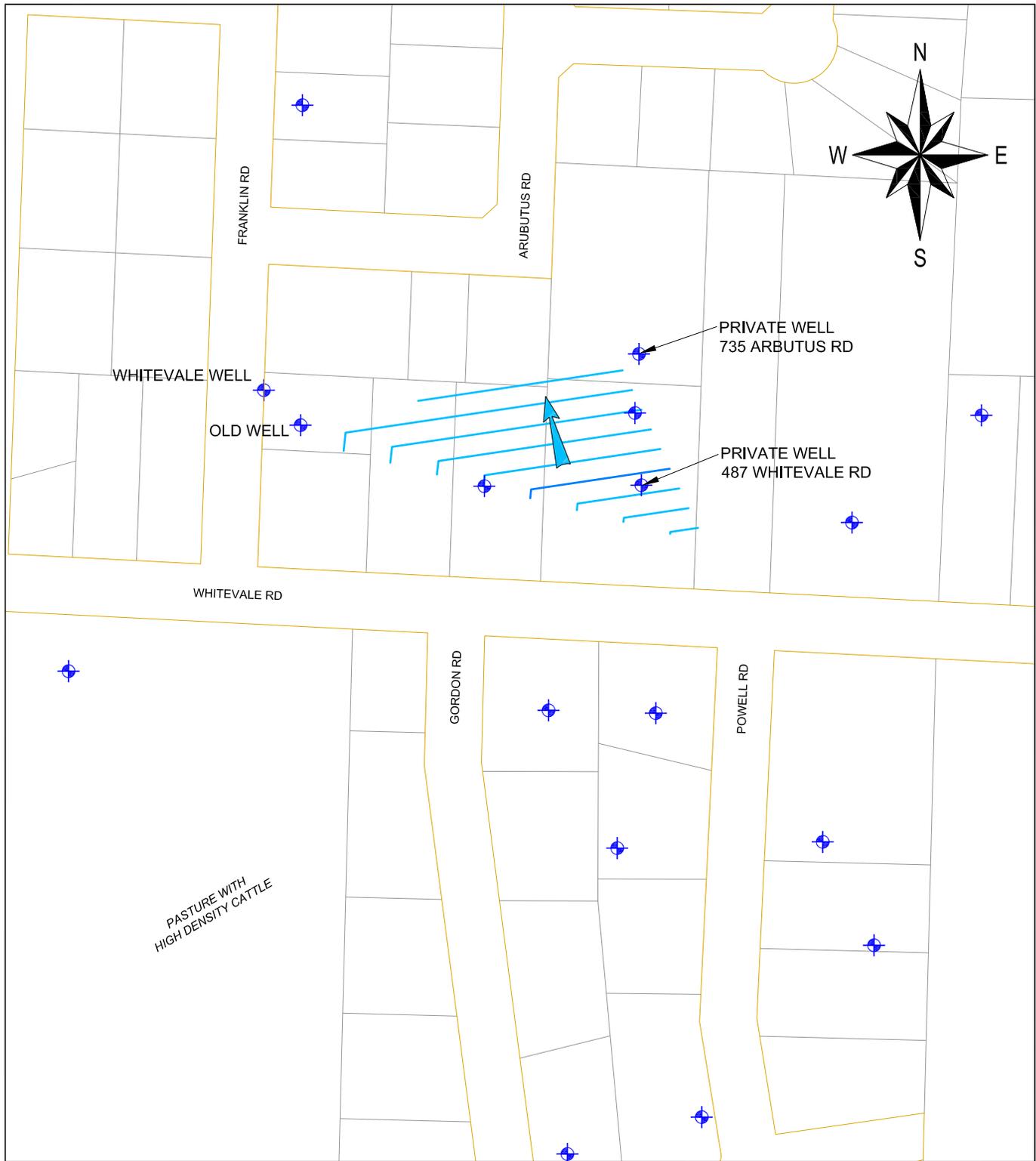
-  WELL LOCATION AND MOE WELL TAG NUMBER (WTN)
-  ACTIVE WELLS NOT IN MOE DATABASE
-  INACTIVE WELLS NOT IN MOE DATABASE
-  DEEP WELLS (47-58 ft) WITHOUT PRESENCE OF LOCAL AQUITARD LAYER
-  INFERRED ABANDONDED CHANNEL

PROJECT **GROUNDWATER PROTECTION PLAN
NORTH OKANAGAN REGIONAL DISTRICT
WHITEVALE, B.C.**

TITLE **WATER WELLS IN STUDY AREA AND
GROUNDWATER FLOW DIRECTION**

 <p>Golder Associates Kelowna, BC</p>	PROJECT No. 07-1440-0089(2000)		FILE No. 0714400089_2000_3.dwg	
	DESIGN	ZM	01/NOV/07	SCALE AS SHOWN
	CADD	SWD	03/JAN/08	REV. 0
	CHECK			
REVIEW				

FIGURE: 5

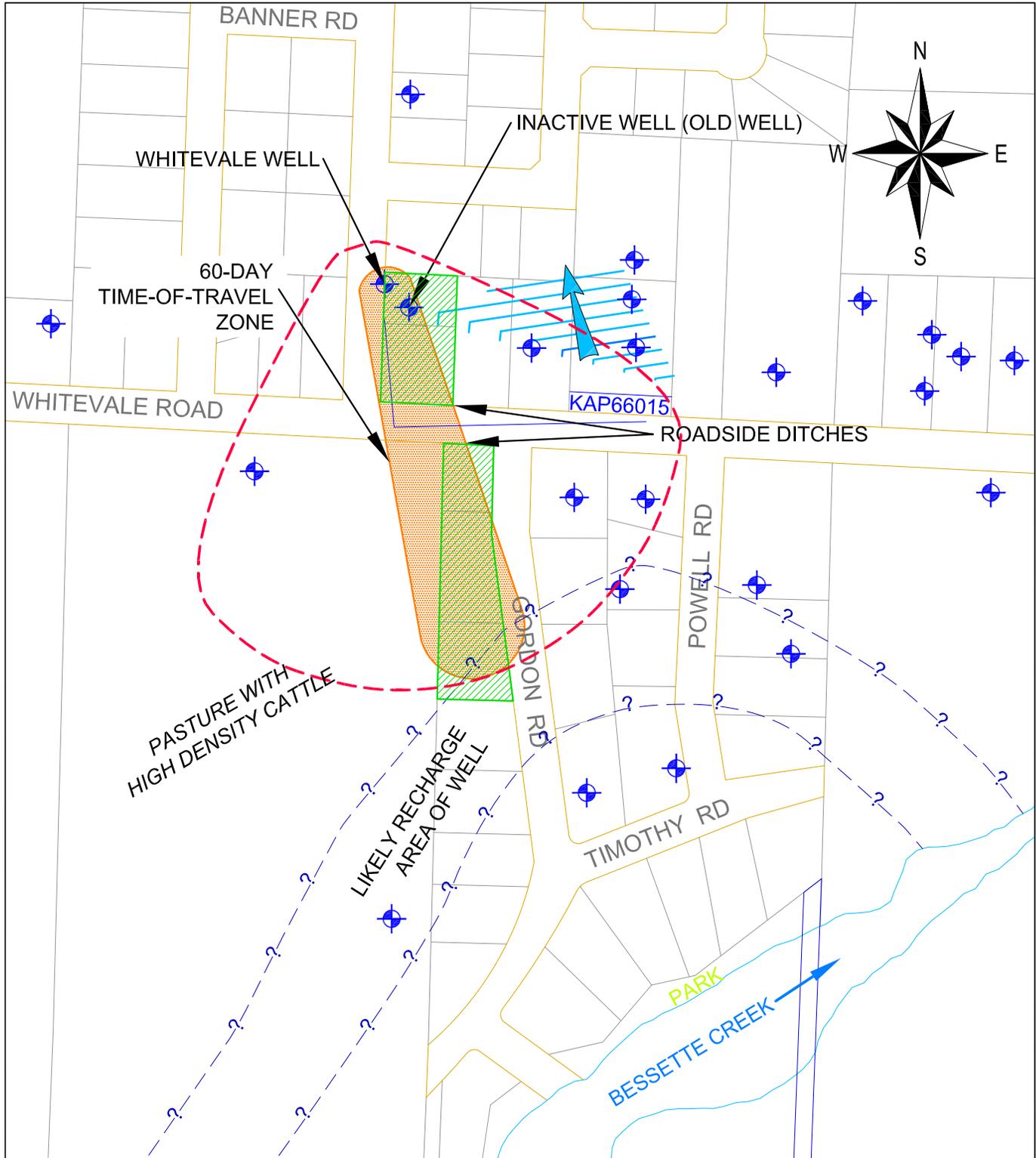


LEGEND

-  WELL LOCATIONS
-  GROUNDWATER FLOW DIRECTION
-  EQUIPOTENTIAL LINES

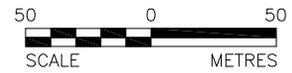
PROJECT		GROUNDWATER PROTECTION PLAN NORTH OKANAGAN REGIONAL DISTRICT WHITEVALE, B.C.				
TITLE		SURVEY RESULTS WITH GROUNDWATER FLOW DIRECTION				
 <p>Golder Associates Kelowna, BC</p>		PROJECT No. 07-1440-0089(2000)		FILE No. 0714400089_2000_6.dwg		
		DESIGN	ZM	22/NOV/07	SCALE	AS SHOWN
		CADD	SWD	03/JAN/08	REV.	0
		CHECK				
		REVIEW				
					FIGURE: 6	

N:\Active\2007\1440 - Kelowna\07-1440-0089 Whitevale\Drafting\Task 2000\CAD\ Drawing file: 0714400089_2000_7.dwg May 06, 2008 - 2:27pm



LEGEND

- WELL LOCATIONS
- GROUNDWATER FLOW DIRECTION
- EQUIPOTENTIAL LINES
- BUFFER AREA OF 60-DAY TIME-OF-TRAVEL ZONE REPRESENTING POTENTIAL VARIATIONS IN GROUNDWATER FLOW DIRECTION AND HYDRAULIC GRADIENT
- INFERRED ABANDONED CHANNEL
- 60-DAY TIME-OF-TRAVEL ZONE
- PROPERTIES THAT LIKELY CONTAIN SEPTIC SYSTEMS IN 60-DAY TIME-OF-TRAVEL ZONE



PROJECT		GROUNDWATER PROTECTION PLAN NORTH OKANAGAN REGIONAL DISTRICT WHITEVALE, B.C.	
TITLE		PRELIMINARY 60-DAY TIME-OF-TRAVEL ZONE AND CONTAMINANT INVENTORY FOR THE WHITEVALE WELL	
PROJECT No. 07-1440-0089(2000)		FILE No. 0714400089_2000_7.dwg	
DESIGN	ZM	22/NOV/07	SCALE AS SHOWN
CADD	SWD	03/JAN/08	REV. 0
CHECK			
REVIEW			



FIGURE: 7

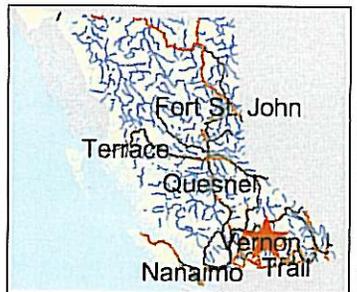
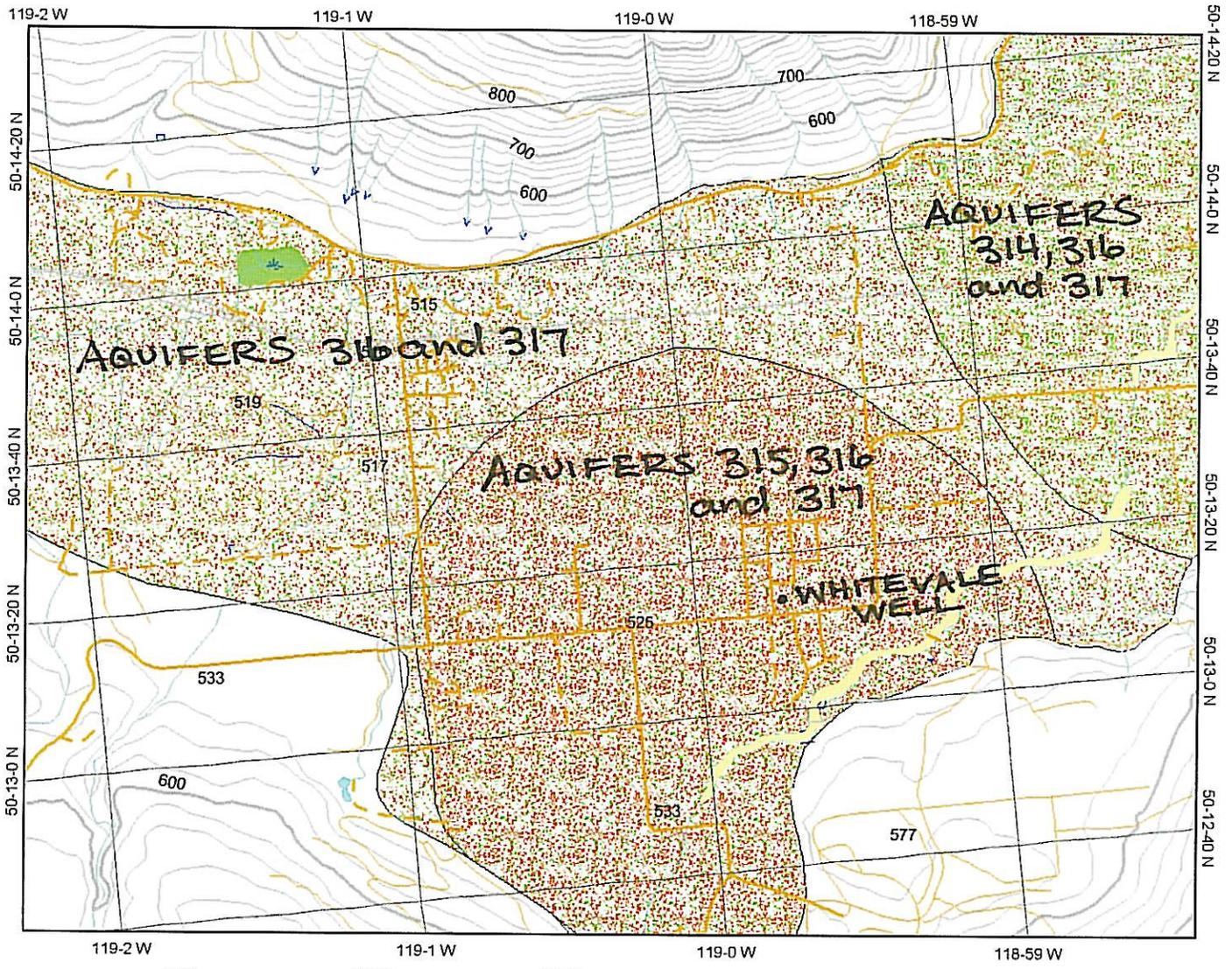
APPENDIX I

**MOE AQUIFER CLASSIFICATION AND AQUIFER EXTENTS IN
THE WHITEVALE AREA**

BC Ministry of Environment Classification of Aquifers in the Lumby and Whitevale Area.

Aq. No	Desc. Location	Materials	Litho Stratographic Unit	Classification	Ranking Value	Size (Km ²)	Productivity	Vulnerability	Demand	Type of Water Use	Quality Concerns	Quantity Concerns
314	Lumby	Sand and Gravel		IIIC	10	6.4	High	Low	Low	Multiple	None	None
315	Bessette Creek Southwest of Lumby	Sand and Gravel		IIA	10	4	Moderate	High	Moderate	Domestic	None	None
316	Lumby	Sand and Gravel		IIIA	9	22	Low	High	Low	Domestic	None	None
317	Lumby	Sand and Gravel		IIIC	9	25	Moderate	Low	Low	Multiple	None	None

Internet Mapping Framework



Legend

Aquifer Vulnerability

- Bedrock, High Vulnerability
- Bedrock, Moderate Vulnerability
- Bedrock, Low Vulnerability
- Unconsolidated, High Vulnerability
- Unconsolidated, Moderate Vulnerability
- Unconsolidated, Low Vulnerability

Landform - Polygons (EBM)

- Dry Riverbed
- Esker
- Lavabed
- Moraine
- Scree
- Slide
- Volcanic Crater
- Rock Outcrop

Contours (TRIM)

- Contour - Index
- Contour - Index, Indefinite
- Contour - Index, Depression
- Contour - Index, Depression Indefinite
- Contour - Intermediate
- Contour - Intermediate, Indefinite
- Contour - Intermediate, Depression
- Contour - Intermediate, Depression Indefinite

Area of Exclusion

- Area of Indefinite Contours

Landform - Points (TRIM)

- Slide

Landform - Lines (TRIM)

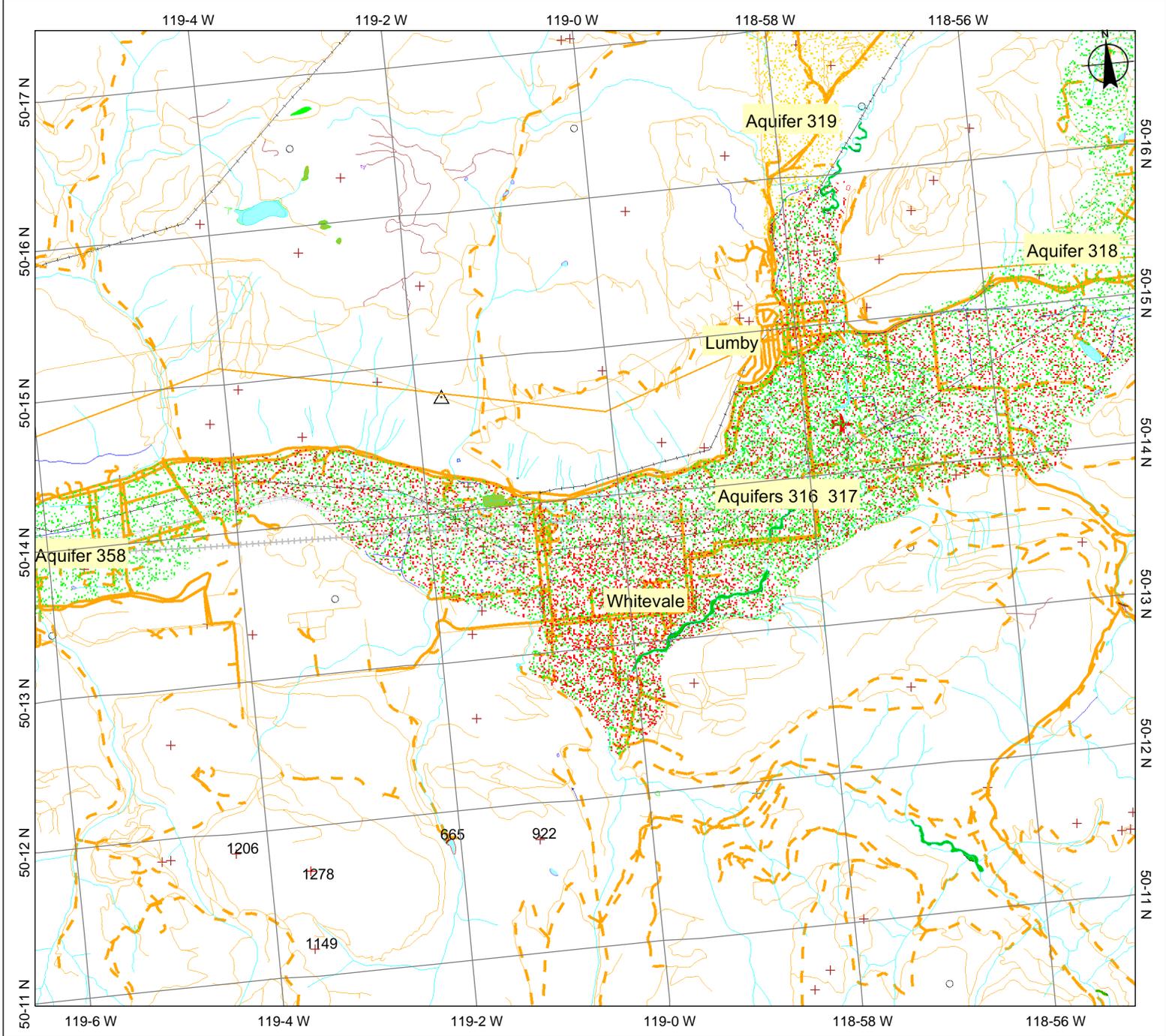
- Cliff
- Crater - Volcanic

Scale: 1:24,999



Map center: 50° 13' 31" N, 119° 0' 14" W

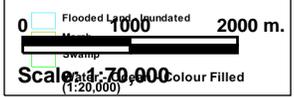
This map is a user generated static output from an Internet mapping site and is for general reference only. Data layers that appear on this map may or may not be accurate, current, or otherwise reliable. THIS MAP IS NOT TO BE USED FOR NAVIGATION.



Boundary extents of Aquifer 317

Legend

- Water - River, Canal, etc. - Colour Themed (1:20,000)**
 - Canal
 - River or Stream - Definite
- Water - River, Canal, etc. - Outlined (1:20,000)**
 - Canal
 - River or Stream - Definite
- Water - Lake, Reservoir, etc. - Colour Themed (1:20,000)**
 - Mine - Tailing Pond
 - Lake - Definite
 - Reservoir - Definite
- Water - Lake, Reservoir, etc. - Outlined (1:20,000)**
 - Mine - Tailing Pond
 - Lake - Definite
 - Reservoir - Definite
- Water - Wetlands - Colour Themed (1:20,000)**
 - Flooded Land - Inundated
 - Marsh
 - Swamp
- Water - Wetlands - Outlined (1:20,000)**
 - Flooded Land - Inundated
 - Marsh
 - Swamp



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Datum/Projection: NAD83, Albers Equal Area Conic

Key Map of British Columbia



APPENDIX II

**WELL LOGS USED IN THE HYDROGEOLOGIC
ASSESSMENT OF THE WHITEVALE WELL**



Report 1 - Detailed Well Record

<p>Well Tag Number: 3270</p> <p>Owner: LINDSEY</p> <p>Address:</p> <p>Area: VERNON</p> <p>WELL LOCATION: OSOYCOOS (ODYD) Land District District Lot: Plan: Lot: Township: Section: Range: Indian Reserve: Meridian: Block: Quarter: Island: BCGS Number (NAD 27): 082L026113 Well: 2</p> <p>Class of Well: Subclass of Well: Orientation of Well: Status of Well: New Well Use: Domestic Observation Well Number: Observation Well Status: Construction Method: Dug Diameter: 0.0 inches Casing drive shoe: Well Depth: 20 feet Elevation: 0 feet (ASL) Final Casing Stick Up: inches Well Cap Type: Bedrock Depth: feet Lithology Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag:</p> <p>Site Info Details: Other Info Flag: Other Info Details:</p>	<p>Construction Date: 1949-01-01 00:00:00.</p> <p>Driller: Unknown Well Identification Plate Number: Plate Attached By: Where Plate Attached:</p> <p>PRODUCTION DATA AT TIME OF DRILLING: Well Yield: 0 (Driller's Estimate) Development Method: Pump Test Info Flag: Artesian Flow: UNKNOWN YIELD Artesian Pressure (ft): Static Level:</p> <p>WATER QUALITY: Character: Colour: Odour: Well Disinfected: N EMS ID: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM):</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>SURFACE SEAL: Flag: Material: Method: Depth (ft): Thickness (in):</p> <p>WELL CLOSURE INFORMATION: Reason For Closure: Method of Closure: Closure Sealant Material: Closure Backfill Material: Details of Closure:</p>												
<table border="1"> <thead> <tr> <th>Screen from</th> <th>to feet</th> <th>Type</th> <th>Slot Size</th> </tr> </thead> <tbody> <tr> <td colspan="4">GENERAL REMARKS:</td> </tr> <tr> <td colspan="4">LITHOLOGY INFORMATION: From 0 to 0 Ft. NO LOG- COARSE GRAVEL & SAND</td> </tr> </tbody> </table>		Screen from	to feet	Type	Slot Size	GENERAL REMARKS:				LITHOLOGY INFORMATION: From 0 to 0 Ft. NO LOG- COARSE GRAVEL & SAND			
Screen from	to feet	Type	Slot Size										
GENERAL REMARKS:													
LITHOLOGY INFORMATION: From 0 to 0 Ft. NO LOG- COARSE GRAVEL & SAND													

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Report 1 - Detailed Well Record

<p>Well Tag Number: 8475</p> <p>Owner: WILSON</p> <p>Address:</p> <p>Area: VERNON</p> <p>WELL LOCATION: OSOYOOS (ODYD) Land District District Lot: Plan: Lot: Township: Section: Range: Indian Reserve: Meridian: Block: Quarter: Island: BCGS Number (NAD 27): 082L026113 Well: 1</p> <p>Class of Well: Subclass of Well: Orientation of Well: Status of Well: New Well Use: Domestic Observation Well Number: Observation Well Status: Construction Method: Dug Diameter: 0.0 inches Casing drive shoe: Well Depth: 25 feet Elevation: 0 feet (ASL) Final Casing Stick Up: inches Well Cap Type: Bedrock Depth: feet Lithology Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag:</p> <p>Site Info Details: Other Info Flag: Other Info Details:</p>	<p>Construction Date: 1950-01-01 00:00:00.</p> <p>Driller: Unknown Well Identification Plate Number: Plate Attached By: Where Plate Attached:</p> <p>PRODUCTION DATA AT TIME OF DRILLING: Well Yield: 0 (Driller's Estimate) Development Method: Pump Test Info Flag: Artesian Flow: UNKNOWN YIELD Artesian Pressure (ft): Static Level: 15 feet</p> <p>WATER QUALITY: Character: Colour: Odour: Well Disinfected: N EMS ID: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM):</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>SURFACE SEAL: Flag: Material: Method: Depth (ft): Thickness (in):</p> <p>WELL CLOSURE INFORMATION: Reason For Closure: Method of Closure: Closure Sealant Material: Closure Backfill Material: Details of Closure:</p>								
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Screen from</th> <th style="text-align: left;">to feet</th> <th style="text-align: left;">Type</th> <th style="text-align: left;">Slot Size</th> </tr> </thead> <tbody> <tr> <td colspan="4" style="height: 20px;"> </td> </tr> </tbody> </table>		Screen from	to feet	Type	Slot Size				
Screen from	to feet	Type	Slot Size						
<p>GENERAL REMARKS:</p> <p>LITHOLOGY INFORMATION: From 0 to 0 Ft. NO LOG- GRAVEL <input type="checkbox"/> & SAND</p>									

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Report 1 - Detailed Well Record

Well Tag Number: 8478	Construction Date: 1950-01-01 00:00:00.
Owner: ATWOOD	Driller: Unknown
Address:	Well Identification Plate Number:
Area: VERNON	Plate Attached By:
WELL LOCATION:	Where Plate Attached:
OSOYOOS (ODYD) Land District	PRODUCTION DATA AT TIME OF DRILLING:
District Lot: Plan: Lot:	Well Yield: 0 (Driller's Estimate)
Township: Section: Range:	Development Method:
Indian Reserve: Meridian: Block:	Pump Test Info Flag:
Quarter:	Artesian Flow: UNKNOWN YIELD
Island:	Artesian Pressure (ft):
BCGS Number (NAD 27): 082L026113 Well: 4	Static Level:
Class of Well:	WATER QUALITY:
Subclass of Well:	Character:
Orientation of Well:	Colour:
Status of Well: New	Odour:
Well Use: Domestic	Well Disinfected: N
Observation Well Number:	EMS ID:
Observation Well Status:	Water Chemistry Info Flag:
Construction Method: Dug	Field Chemistry Info Flag:
Diameter: 0.0 inches	Site Info (SEAM):
Casing drive shoe:	Water Utility:
Well Depth: 25 feet	Water Supply System Name:
Elevation: 0 feet (ASL)	Water Supply System Well Name:
Final Casing Stick Up: inches	SURFACE SEAL:
Well Cap Type:	Flag:
Bedrock Depth: feet	Material:
Lithology Info Flag:	Method:
File Info Flag:	Depth (ft):
Sieve Info Flag:	Thickness (in):
Screen Info Flag:	WELL CLOSURE INFORMATION:
Site Info Details:	Reason For Closure:
Other Info Flag:	Method of Closure:
Other Info Details:	Closure Sealant Material:
	Closure Backfill Material:
	Details of Closure:
Screen from to feet Type Slot Size	
GENERAL REMARKS:	
LITHOLOGY INFORMATION:	
From 0 to 0 Ft. NO LOG- SANDY TILL, SAND & GRAVEL	

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Report 1 - Detailed Well Record

<p>Well Tag Number: 8482</p> <p>Owner: N O'NEIL</p> <p>Address:</p> <p>Area: VERNON</p> <p>WELL LOCATION: OSOYOOS (ODYD) Land District District Lot: Plan: Lot: Township: Section: Range: Indian Reserve: Meridian: Block: Quarter: Island: BCGS Number (NAD 27): 082L026113 Well: 8</p> <p>Class of Well: Subclass of Well: Orientation of Well: Status of Well: New Well Use: Domestic Observation Well Number: Observation Well Status: Construction Method: Dug Diameter: 0.0 inches Casing drive shoe: Well Depth: 24 feet Elevation: 0 feet (ASL) Final Casing Stick Up: inches Well Cap Type: Bedrock Depth: feet Lithology Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag:</p> <p>Site Info Details: Other Info Flag: Other Info Details:</p>	<p>Construction Date: 1950-01-01 00:00:00.0</p> <p>Driller: Unknown Well Identification Plate Number: Plate Attached By: Where Plate Attached:</p> <p>PRODUCTION DATA AT TIME OF DRILLING: Well Yield: 0 (Driller's Estimate) Development Method: Pump Test Info Flag: Artesian Flow: UNKNOWN YIELD Artesian Pressure (ft): Static Level: 20 feet</p> <p>WATER QUALITY: Character: Colour: Odour: Well Disinfected: N EMS ID: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM):</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>SURFACE SEAL: Flag: Material: Method: Depth (ft): Thickness (in):</p> <p>WELL CLOSURE INFORMATION: Reason For Closure: Method of Closure: Closure Sealant Material: Closure Backfill Material: Details of Closure:</p>												
<table border="1"> <thead> <tr> <th>Screen from</th> <th>to feet</th> <th>Type</th> <th>Slot Size</th> </tr> </thead> <tbody> <tr> <td colspan="4">GENERAL REMARKS:</td> </tr> <tr> <td colspan="4">LITHOLOGY INFORMATION: From 0 to 0 Ft. NO LOG- SANDY SOIL GRAVEL, SOME SAND</td> </tr> </tbody> </table>		Screen from	to feet	Type	Slot Size	GENERAL REMARKS:				LITHOLOGY INFORMATION: From 0 to 0 Ft. NO LOG- SANDY SOIL GRAVEL, SOME SAND			
Screen from	to feet	Type	Slot Size										
GENERAL REMARKS:													
LITHOLOGY INFORMATION: From 0 to 0 Ft. NO LOG- SANDY SOIL GRAVEL, SOME SAND													

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Report 1 - Detailed Well Record

<p>Well Tag Number: 14209</p> <p>Owner: G DEIS</p> <p>Address:</p> <p>Area:</p> <p>WELL LOCATION: OSOYOOS (ODYD) Land District District Lot: Plan: Lot: Township: Section: Range: Indian Reserve: Meridian: Block: Quarter: Island: BCGS Number (NAD 27): 082L026113 Well: 10</p> <p>Class of Well: Subclass of Well: Orientation of Well: Status of Well: New Well Use: Domestic Observation Well Number: Observation Well Status: Construction Method: Dug Diameter: 0.0 inches Casing drive shoe: Well Depth: 10 feet Elevation: 0 feet (ASL) Final Casing Stick Up: inches Well Cap Type: Bedrock Depth: feet Lithology Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag:</p> <p>Site Info Details: Other Info Flag: Other Info Details:</p>	<p>Construction Date: 1954-01-01 00:00:00.0</p> <p>Driller: Unknown Well Identification Plate Number: Plate Attached By: Where Plate Attached:</p> <p>PRODUCTION DATA AT TIME OF DRILLING: Well Yield: 0 (Driller's Estimate) Development Method: Pump Test Info Flag: Artesian Flow: UNKNOWN YIELD Artesian Pressure (ft): Static Level: 2 feet</p> <p>WATER QUALITY: Character: Colour: Odour: Well Disinfected: N EMS ID: Water Chemistry Info Flag: Field Chemistry Info Flag: Y Site Info (SEAM):</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>SURFACE SEAL: Flag: Material: Method: Depth (ft): Thickness (in):</p> <p>WELL CLOSURE INFORMATION: Reason For Closure: Method of Closure: Closure Sealant Material: Closure Backfill Material: Details of Closure:</p>
<p>Screen from to feet Type Slot Size</p>	
<p>GENERAL REMARKS:</p>	
<p>LITHOLOGY INFORMATION: From 0 to 0 Ft. NO LOG- TOPSOIL GRAVEL</p>	

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Report 1 - Detailed Well Record

<p>Well Tag Number: 15527</p> <p>Owner: R COX</p> <p>Address:</p> <p>Area: VERNON</p> <p>WELL LOCATION: OSOYOOS (ODYD) Land District District Lot: Plan: Lot: Township: Section: Range: Indian Reserve: Meridian: Block: Quarter: Island: BCGS Number (NAD 27): 082L026113 Well: 9</p> <p>Class of Well: Subclass of Well: Orientation of Well: Status of Well: New Well Use: Domestic Observation Well Number: Observation Well Status: Construction Method: Drilled Diameter: 0.0 inches Casing drive shoe: Well Depth: 20 feet Elevation: 0 feet (ASL) Final Casing Stick Up: inches Well Cap Type: Bedrock Depth: feet Lithology Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag:</p> <p>Site Info Details: Other Info Flag: Other Info Details:</p>	<p>Construction Date: 1958-01-01 00:00:00.0</p> <p>Driller: Unknown Well Identification Plate Number: Plate Attached By: Where Plate Attached:</p> <p>PRODUCTION DATA AT TIME OF DRILLING: Well Yield: 0 (Driller's Estimate) Development Method: Pump Test Info Flag: Artesian Flow: UNKNOWN YIELD Artesian Pressure (ft): Static Level: 10 feet</p> <p>WATER QUALITY: Character: Colour: Odour: Well Disinfected: N EMS ID: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM):</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>SURFACE SEAL: Flag: Material: Method: Depth (ft): Thickness (in):</p> <p>WELL CLOSURE INFORMATION: Reason For Closure: Method of Closure: Closure Sealant Material: Closure Backfill Material: Details of Closure:</p>
<p>Screen from to feet Type Slot Size</p>	
<p>GENERAL REMARKS:</p> <p>LITHOLOGY INFORMATION: From 0 to 0 Ft. NO LOG- TOPSOIL SAND & GRAVEL</p>	

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Report 1 - Detailed Well Record

<p>Well Tag Number: 15864</p> <p>Owner: J SUMMERFELT</p> <p>Address:</p> <p>Area: VERNON</p> <p>WELL LOCATION: OSOYOOS (ODYD) Land District District Lot: Plan: Lot: Township: Section: Range: Indian Reserve: Meridian: Block: Quarter: Island: BCGS Number (NAD 27): 082L026113 Well: 6</p> <p>Class of Well: Subclass of Well: Orientation of Well: Status of Well: New Well Use: Domestic Observation Well Number: Observation Well Status: Construction Method: Drilled Diameter: 0.0 inches Casing drive shoe: Well Depth: 42 feet Elevation: 0 feet (ASL) Final Casing Stick Up: inches Well Cap Type: Bedrock Depth: feet Lithology Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag:</p> <p>Site Info Details: Other Info Flag: Other Info Details:</p>	<p>Construction Date: 1959-01-01 00:00:00.</p> <p>Driller: Hartwig Well Identification Plate Number: Plate Attached By: Where Plate Attached:</p> <p>PRODUCTION DATA AT TIME OF DRILLING: Well Yield: 0 (Driller's Estimate) Development Method: Pump Test Info Flag: Artesian Flow: UNKNOWN YIELD Artesian Pressure (ft): Static Level: 9 feet</p> <p>WATER QUALITY: Character: Colour: Odour: Well Disinfected: N EMS ID: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM):</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>SURFACE SEAL: Flag: Material: Method: Depth (ft): Thickness (in):</p> <p>WELL CLOSURE INFORMATION: Reason For Closure: Method of Closure: Closure Sealant Material: Closure Backfill Material: Details of Closure:</p>
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Screen from	to feet	Type	Slot Size
-------------	---------	------	-----------

GENERAL REMARKS:

LITHOLOGY INFORMATION:

From	0 to	5 Ft.	SANDY SOIL
From	5 to	38 Ft.	GRAVEL
From	38 to	40 Ft.	HARDPAN
From	40 to	42 Ft.	GRAVEL

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Report 1 - Detailed Well Record

<p>Well Tag Number: 16876</p> <p>Owner: F HINZ</p> <p>Address:</p> <p>Area: VERNON</p> <p>WELL LOCATION: OSOYOOS (ODYD) Land District District Lot: Plan: Lot: Township: Section: Range: Indian Reserve: Meridian: Block: Quarter: Island: BCGS Number (NAD 27): 082L026113 Well: 11</p> <p>Class of Well: Subclass of Well: Orientation of Well: Status of Well: New Well Use: Domestic Observation Well Number: Observation Well Status: Construction Method: Dug Diameter: 0.0 inches Casing drive shoe: Well Depth: 12 feet Elevation: 0 feet (ASL) Final Casing Stick Up: inches Well Cap Type: Bedrock Depth: feet Lithology Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag:</p> <p>Site Info Details: Other Info Flag: Other Info Details:</p>	<p>Construction Date: 1961-01-01 00:00:00.0</p> <p>Driller: Unknown Well Identification Plate Number: Plate Attached By: Where Plate Attached:</p> <p>PRODUCTION DATA AT TIME OF DRILLING: Well Yield: 0 (Driller's Estimate) Development Method: Pump Test Info Flag: Artesian Flow: UNKNOWN YIELD Artesian Pressure (ft): Static Level:</p> <p>WATER QUALITY: Character: Colour: Odour: Well Disinfected: N EMS ID: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM):</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>SURFACE SEAL: Flag: Material: Method: Depth (ft): Thickness (in):</p> <p>WELL CLOSURE INFORMATION: Reason For Closure: Method of Closure: Closure Sealant Material: Closure Backfill Material: Details of Closure:</p>
<p>Screen from to feet Type Slot Size</p>	
<p>GENERAL REMARKS:</p>	
<p>LITHOLOGY INFORMATION: From 0 to 0 Ft. NO LOG- SANDY SOIL</p>	

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Report 1 - Detailed Well Record

<p>Well Tag Number: 17539</p> <p>Owner: ADOLPH SUMMERFELT</p> <p>Address:</p> <p>Area: VERNON</p> <p>WELL LOCATION: OSOYOOS (ODYD) Land District District Lot: 417 Plan: Lot: Township: Section: Range: Indian Reserve: Meridian: Block: Quarter: Island: BCGS Number (NAD 27): 082L026113 Well: 5</p> <p>Class of Well: Subclass of Well: Orientation of Well: Status of Well: New Well Use: Domestic Observation Well Number: Observation Well Status: Construction Method: Drilled Diameter: 0.0 inches Casing drive shoe: Well Depth: 40 feet Elevation: 0 feet (ASL) Final Casing Stick Up: inches Well Cap Type: Bedrock Depth: feet Lithology Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag:</p> <p>Site Info Details: Other Info Flag: Other Info Details:</p>	<p>Construction Date: 1962-07-01 00:00:00.</p> <p>Driller: Okanagan Water Well Drilling Well Identification Plate Number: Plate Attached By: Where Plate Attached:</p> <p>PRODUCTION DATA AT TIME OF DRILLING: Well Yield: 800 (Driller's Estimate) Development Method: Pump Test Info Flag: Artesian Flow: UNKNOWN YIELD Artesian Pressure (ft): Static Level: 22 feet</p> <p>WATER QUALITY: Character: Colour: Odour: Well Disinfected: N EMS ID: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM):</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>SURFACE SEAL: Flag: Material: Method: Depth (ft): Thickness (in):</p> <p>WELL CLOSURE INFORMATION: Reason For Closure: Method of Closure: Closure Sealant Material: Closure Backfill Material: Details of Closure:</p>
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Screen from	to feet	Type	Slot Size
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GENERAL REMARKS:
DRAWDOWN AT 4 FEET.

LITHOLOGY INFORMATION:

From	0 to	14 Ft.	BROWN CLAY WITH ROCKS & BOULDERS
From	14 to	40 Ft.	MOSTLY CLEAN ROCK & GRAVEL
From	0 to	0 Ft.	
From	0 to	0 Ft.	WATER AT 14'-WELL WAS DRILLED TO 40'
From	0 to	0 Ft.	BECAUSE WHEN CREEK GOES DRY W.L. DROPS
From	0 to	0 Ft.	TO 22'.



Report 1 - Detailed Well Record

<p>Well Tag Number: 17540</p> <p>Owner: ALBERT HINZ</p> <p>Address:</p> <p>Area: VERNON</p> <p>WELL LOCATION: OSOYOOS (ODYD) Land District District Lot: 417 Plan: Lot: Township: Section: Range: Indian Reserve: Meridian: Block: Quarter: Island: BCGS Number (NAD 27): 082L026113 Well: 3</p> <p>Class of Well: Subclass of Well: Orientation of Well: Status of Well: New Well Use: Domestic Observation Well Number: Observation Well Status: Construction Method: Drilled Diameter: 4.0 inches Casing drive shoe: Well Depth: 36 feet Elevation: 0 feet (ASL) Final Casing Stick Up: inches Well Cap Type: Bedrock Depth: feet Lithology Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag:</p> <p>Site Info Details: Other Info Flag: Other Info Details:</p>	<p>Construction Date: 1962-07-01 00:00:00.</p> <p>Driller: Okanagan Water Well Drilling Well Identification Plate Number: Plate Attached By: Where Plate Attached:</p> <p>PRODUCTION DATA AT TIME OF DRILLING: Well Yield: 800 (Driller's Estimate) Development Method: Pump Test Info Flag: Artesian Flow: UNKNOWN YIELD Artesian Pressure (ft): Static Level: 22 feet</p> <p>WATER QUALITY: Character: Colour: Odour: Well Disinfected: N EMS ID: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM):</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>SURFACE SEAL: Flag: Material: Method: Depth (ft): Thickness (in):</p> <p>WELL CLOSURE INFORMATION: Reason For Closure: Method of Closure: Closure Sealant Material: Closure Backfill Material: Details of Closure:</p>
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Screen from	to feet	Type	Slot Size
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GENERAL REMARKS:
DRAWDOWN AT 4 FEET.

LITHOLOGY INFORMATION:

From	0 to	4 Ft.	BROWN CLAY, ROCK & GRAVEL
From	4 to	36 Ft.	CLEAN ROCK, GRAVEL & SAND
From	0 to	0 Ft.	
From	0 to	0 Ft.	WATER AT 12'-WELL WAS DRILLED TO 36'
From	0 to	0 Ft.	BECAUSE WHEN CREEK GOES DRY W.L. DROPS
From	0 to	0 Ft.	TO 22'.



Report 1 - Detailed Well Record

<p>Well Tag Number: 17855</p> <p>Owner: FLINT</p> <p>Address:</p> <p>Area:</p> <p>WELL LOCATION: OSOYOOS (ODYD) Land District District Lot: Plan: Lot: Township: Section: Range: Indian Reserve: Meridian: Block: Quarter: Island: BCGS Number (NAD 27): 082L026113 Well: 7</p> <p>Class of Well: Subclass of Well: Orientation of Well: Status of Well: New Well Use: Domestic Observation Well Number: Observation Well Status: Construction Method: Drilled Diameter: 0.0 inches Casing drive shoe: Well Depth: 26 feet Elevation: 0 feet (ASL) Final Casing Stick Up: inches Well Cap Type: Bedrock Depth: feet Lithology Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag:</p> <p>Site Info Details: Other Info Flag: Other Info Details:</p>	<p>Construction Date: 1963-01-01 00:00:00.</p> <p>Driller: Unknown Well Identification Plate Number: Plate Attached By: Where Plate Attached:</p> <p>PRODUCTION DATA AT TIME OF DRILLING: Well Yield: 0 (Driller's Estimate) Development Method: Pump Test Info Flag: Artesian Flow: UNKNOWN YIELD Artesian Pressure (ft): Static Level: 9 feet</p> <p>WATER QUALITY: Character: Colour: Odour: Well Disinfected: N EMS ID: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM):</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>SURFACE SEAL: Flag: Material: Method: Depth (ft): Thickness (in):</p> <p>WELL CLOSURE INFORMATION: Reason For Closure: Method of Closure: Closure Sealant Material: Closure Backfill Material: Details of Closure:</p>																				
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Screen from	to feet	Type	Slot Size																		
GENERAL REMARKS:																					
LITHOLOGY INFORMATION:																					
From	0 to	5 Ft.	SANDY SOIL																		
From	5 to	26 Ft.	GRAVEL & SAND																		

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Report 1 - Detailed Well Record

<p>Well Tag Number: 22154</p> <p>Owner: LEO VALOUGH ENT LTD</p> <p>Address:</p> <p>Area: VERNON</p> <p>WELL LOCATION: OSOYOOS (ODYD) Land District District Lot: 418 Plan: 3832 Lot: Township: Section: Range: Indian Reserve: Meridian: Block: Quarter: Island: BCGS Number (NAD 27): 082L026113 Well: 18</p> <p>Class of Well: Subclass of Well: Orientation of Well: Status of Well: New Well Use: Unknown Well Use Observation Well Number: Observation Well Status: Construction Method: Drilled Diameter: 8.5 inches Casing drive shoe: Well Depth: 68 feet Elevation: 0 feet (ASL) Final Casing Stick Up: inches Well Cap Type: Bedrock Depth: feet Lithology Info Flag: File Info Flag: Y Sieve Info Flag: Screen Info Flag:</p> <p>Site Info Details: Other Info Flag: Other Info Details:</p>	<p>Construction Date: 1969-01-05 00:00:00</p> <p>Driller: Okanagan Rotary Well Drilling Well Identification Plate Number: Plate Attached By: Where Plate Attached:</p> <p>PRODUCTION DATA AT TIME OF DRILLING: Well Yield: 53 (Driller's Estimate) Development Method: Pump Test Info Flag: Y Artesian Flow: UNKNOWN YIELD Artesian Pressure (ft): Static Level: 21 feet</p> <p>WATER QUALITY: Character: Colour: Odour: Well Disinfected: N EMS ID: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM):</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>SURFACE SEAL: Flag: Material: Method: Depth (ft): Thickness (in):</p> <p>WELL CLOSURE INFORMATION: Reason For Closure: Method of Closure: Closure Sealant Material: Closure Backfill Material: Details of Closure:</p>
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Screen from	to feet	Type	Slot Size
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GENERAL REMARKS:

LITHOLOGY INFORMATION:

From	0 to	5 Ft.	BROWN CLAY
From	5 to	20 Ft.	BROWN SANDY CLAY WITH ROCKS
From	20 to	32 Ft.	HARDPAN
From	32 to	36 Ft.	SOFT SANDY CLAY WITH ROCKS
From	36 to	44 Ft.	SAND WITH STONES
From	44 to	68 Ft.	VERY COARSE CLEAN GRAVEL



Report 1 - Detailed Well Record

<p>Well Tag Number: 31325</p> <p>Owner: GEROVAC M</p> <p>Address: MILL RD</p> <p>Area: LUMBY</p> <p>WELL LOCATION: OSOYOOS (ODYD) Land District District Lot: Plan: 11243 Lot: 1 Township: 3 Section: 15 Range: Indian Reserve: Meridian: Block: Quarter: Island: BCGS Number (NAD 27): 082L026113 Well: 19</p> <p>Class of Well: Subclass of Well: Orientation of Well: Status of Well: New Well Use: Unknown Well Use Observation Well Number: Observation Well Status: Construction Method: Drilled Diameter: 0.0 inches Casing drive shoe: Well Depth: 43 feet Elevation: 0 feet (ASL) Final Casing Stick Up: inches Well Cap Type: Bedrock Depth: feet Lithology Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag:</p> <p>Site Info Details: Other Info Flag: Other Info Details:</p>	<p>Construction Date: 1974-09-25 00:00:00</p> <p>Driller: Pacific Water Wells Well Identification Plate Number: Plate Attached By: Where Plate Attached:</p> <p>PRODUCTION DATA AT TIME OF DRILLING: Well Yield: 10 (Driller's Estimate) Development Method: Pump Test Info Flag: Artesian Flow: UNKNOWN YIELD Artesian Pressure (ft): Static Level: 20 feet</p> <p>WATER QUALITY: Character: Colour: Odour: Well Disinfected: N EMS ID: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM):</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>SURFACE SEAL: Flag: Material: Method: Depth (ft): Thickness (in):</p> <p>WELL CLOSURE INFORMATION: Reason For Closure: Method of Closure: Closure Sealant Material: Closure Backfill Material: Details of Closure:</p>																				
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Screen from	to feet	Type	Slot Size																		
GENERAL REMARKS:																					
LITHOLOGY INFORMATION:																					
From	0 to	35 Ft.	TILL																		
From	35 to	43 Ft.	GRAVEL, WATER-BEARING																		

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Report 1 - Detailed Well Record

<p>Well Tag Number: 32644</p> <p>Owner: FRANK O'NEILL</p> <p>Address: WHITEVALE RD</p> <p>Area: VERNON</p> <p>WELL LOCATION: OSOYOOS (ODYD) Land District District Lot: 418 Plan: 3832 Lot: 3 Township: Section: Range: Indian Reserve: Meridian: Block: Quarter: Island: BCGS Number (NAD 27): 082L026113 Well: 20</p> <p>Class of Well: Subclass of Well: Orientation of Well: Status of Well: New Well Use: Unknown Well Use Observation Well Number: Observation Well Status: Construction Method: Drilled Diameter: 0.0 inches Casing drive shoe: Well Depth: 47 feet Elevation: 0 feet (ASL) Final Casing Stick Up: inches Well Cap Type: Bedrock Depth: feet Lithology Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag:</p> <p>Site Info Details: Other Info Flag: Other Info Details:</p>	<p>Construction Date: 1975-06-02 00:00:00</p> <p>Driller: Pacific Pump & Pressure Well Identification Plate Number: Plate Attached By: Where Plate Attached:</p> <p>PRODUCTION DATA AT TIME OF DRILLING: Well Yield: 480 (Driller's Estimate) Development Method: Pump Test Info Flag: Artesian Flow: UNKNOWN YIELD Artesian Pressure (ft): Static Level: 30 feet</p> <p>WATER QUALITY: Character: Colour: Odour: Well Disinfected: N EMS ID: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM):</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>SURFACE SEAL: Flag: Material: Method: Depth (ft): Thickness (in):</p> <p>WELL CLOSURE INFORMATION: Reason For Closure: Method of Closure: Closure Sealant Material: Closure Backfill Material: Details of Closure:</p>
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Screen from	to feet	Type	Slot Size
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GENERAL REMARKS:

LITHOLOGY INFORMATION:

From	0 to	20 Ft.	DUG HOLE
From	2 to	42 Ft.	TILL
From	42 to	47 Ft.	WATER-BEARING GRAVEL

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Report 1 - Detailed Well Record

<p>Well Tag Number: 37323</p> <p>Owner: CECIL B WILLS</p> <p>Address: WHITEVALE RD</p> <p>Area: LUMBY</p> <p>WELL LOCATION: OSOYOOS (ODYD) Land District District Lot: Plan: 27776 Lot: 1 Township: 3 Section: 15 Range: Indian Reserve: Meridian: Block: Quarter: Island: BCGS Number (NAD 27): 082L026113 Well: 21</p> <p>Class of Well: Subclass of Well: Orientation of Well: Status of Well: New Well Use: Unknown Well Use Observation Well Number: Observation Well Status: Construction Method: Drilled Diameter: 6.0 inches Casing drive shoe: Well Depth: 50 feet Elevation: 0 feet (ASL) Final Casing Stick Up: inches Well Cap Type: Bedrock Depth: feet Lithology Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag:</p> <p>Site Info Details: Other Info Flag: Other Info Details:</p>	<p>Construction Date: 1977-06-01 00:00:00</p> <p>Driller: Thomas Well Drilling Well Identification Plate Number: Plate Attached By: Where Plate Attached:</p> <p>PRODUCTION DATA AT TIME OF DRILLING: Well Yield: 20 (Driller's Estimate) Development Method: Pump Test Info Flag: Artesian Flow: UNKNOWN YIELD Artesian Pressure (ft): Static Level: 20 feet</p> <p>WATER QUALITY: Character: Colour: Odour: Well Disinfected: N EMS ID: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM):</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>SURFACE SEAL: Flag: Material: Method: Depth (ft): Thickness (in):</p> <p>WELL CLOSURE INFORMATION: Reason For Closure: Method of Closure: Closure Sealant Material: Closure Backfill Material: Details of Closure:</p>
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Screen from	to feet	Type	Slot Size
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GENERAL REMARKS:			
LITHOLOGY INFORMATION:			
From	0 to	25 Ft.	DRY GRAVEL
From	25 to	42 Ft.	WATER-BEARING CLAY
From	42 to	50 Ft.	WATER-BEARING GRAVEL

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Report 1 - Detailed Well Record

<p>Well Tag Number: 38347</p> <p>Owner: CECIL B WILLS</p> <p>Address: WHITEVALE RD</p> <p>Area: LUMBY</p> <p>WELL LOCATION: OSOYOOS (ODYD) Land District District Lot: Plan: 26780 Lot: 1 Township: 3 Section: 15 Range: Indian Reserve: Meridian: Block: Quarter: Island: BCGS Number (NAD 27): 082L026113 Well: 13</p> <p>Class of Well: Subclass of Well: Orientation of Well: Status of Well: New Well Use: Unknown Well Use Observation Well Number: Observation Well Status: Construction Method: Drilled Diameter: 6.0 inches Casing drive shoe: Well Depth: 54 feet Elevation: 0 feet (ASL) Final Casing Stick Up: inches Well Cap Type: Bedrock Depth: feet Lithology Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag:</p> <p>Site Info Details: Other Info Flag: Other Info Details:</p>	<p>Construction Date: 1977-10-06 00:00:00</p> <p>Driller: Thomas Well Drilling Well Identification Plate Number: Plate Attached By: Where Plate Attached:</p> <p>PRODUCTION DATA AT TIME OF DRILLING: Well Yield: 25 (Driller's Estimate) Development Method: Pump Test Info Flag: Artesian Flow: UNKNOWN YIELD Artesian Pressure (ft): Static Level: 13 feet</p> <p>WATER QUALITY: Character: Colour: Odour: Well Disinfected: N EMS ID: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM):</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>SURFACE SEAL: Flag: Material: Method: Depth (ft): Thickness (in):</p> <p>WELL CLOSURE INFORMATION: Reason For Closure: Method of Closure: Closure Sealant Material: Closure Backfill Material: Details of Closure:</p>																								
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Screen from	to feet	Type	Slot Size																						
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From	24 to	45 Ft.	WATER-BEARING CLAY																						
From	45 to	54 Ft.	WATER-BEARING GRAVEL																						

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Report 1 - Detailed Well Record

<p>Well Tag Number: 41503</p> <p>Owner: HERMAN CORDES</p> <p>Address: WHITEVALE RD</p> <p>Area: LUMBY</p> <p>WELL LOCATION: OSOYOOS (ODYD) Land District District Lot: Plan: 14732 Lot: 2 Township: 3 Section: 15 Range: Indian Reserve: Meridian: Block: Quarter: Island: BCGS Number (NAD 27): 082L026113 Well: 23</p> <p>Class of Well: Subclass of Well: Orientation of Well: Status of Well: New Well Use: Unknown Well Use Observation Well Number: Observation Well Status: Construction Method: Drilled Diameter: 6.0 inches Casing drive shoe: Well Depth: 40 feet Elevation: 0 feet (ASL) Final Casing Stick Up: inches Well Cap Type: Bedrock Depth: feet Lithology Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag:</p> <p>Site Info Details: Other Info Flag: Other Info Details:</p>	<p>Construction Date: 1979-01-01 00:00:00.0</p> <p>Driller: Thomas Well Drilling Well Identification Plate Number: Plate Attached By: Where Plate Attached:</p> <p>PRODUCTION DATA AT TIME OF DRILLING: Well Yield: 35 (Driller's Estimate) Gallons per Min Development Method: Pump Test Info Flag: Artesian Flow: UNKNOWN YIELD Artesian Pressure (ft): Static Level: 25 feet</p> <p>WATER QUALITY: Character: Colour: Odour: Well Disinfected: N EMS ID: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM):</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>SURFACE SEAL: Flag: Material: Method: Depth (ft): Thickness (in):</p> <p>WELL CLOSURE INFORMATION: Reason For Closure: Method of Closure: Closure Sealant Material: Closure Backfill Material: Details of Closure:</p>																				
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Screen from	to feet	Type	Slot Size																		
GENERAL REMARKS:																					
LITHOLOGY INFORMATION:																					
From	0 to	24 Ft.	DUG WELL																		
From	24 to	40 Ft.	WATER-BEARING GRAVEL																		

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Report 1 - Detailed Well Record

<p>Well Tag Number: 41504</p> <p>Owner: FRANK WERNITZNIC</p> <p>Address: POWELL RD</p> <p>Area: LUMBY</p> <p>WELL LOCATION: OSOYOOS (ODYD) Land District District Lot: 417 Plan: 23924 Lot: 2 Township: Section: Range: Indian Reserve: Meridian: Block: Quarter: Island: BCGS Number (NAD 27): 082L026113 Well: 25</p> <p>Class of Well: Subclass of Well: Orientation of Well: Status of Well: New Well Use: Unknown Well Use Observation Well Number: Observation Well Status: Construction Method: Drilled Diameter: 6.0 inches Casing drive shoe: Well Depth: 48 feet Elevation: 0 feet (ASL) Final Casing Stick Up: inches Well Cap Type: Bedrock Depth: feet Lithology Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag:</p> <p>Site Info Details: Other Info Flag: Other Info Details:</p>	<p>Construction Date: 1979-01-01 00:00:00</p> <p>Driller: Thomas Well Drilling Well Identification Plate Number: Plate Attached By: Where Plate Attached:</p> <p>PRODUCTION DATA AT TIME OF DRILLING: Well Yield: 30 (Driller's Estimate) Development Method: Pump Test Info Flag: Artesian Flow: UNKNOWN YIELD Artesian Pressure (ft): Static Level: 32 feet</p> <p>WATER QUALITY: Character: Colour: Odour: Well Disinfected: N EMS ID: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM):</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>SURFACE SEAL: Flag: Material: Method: Depth (ft): Thickness (in):</p> <p>WELL CLOSURE INFORMATION: Reason For Closure: Method of Closure: Closure Sealant Material: Closure Backfill Material: Details of Closure:</p>																								
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Screen from	to feet	Type	Slot Size																						
GENERAL REMARKS:																									
LITHOLOGY INFORMATION:																									
From	0 to	6 Ft.	OPEN PIT																						
From	6 to	32 Ft.	SAND, GRAVEL																						
From	32 to	47 Ft.	WATER-BEARING GRAVEL																						

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Report 1 - Detailed Well Record

<p>Well Tag Number: 41508</p> <p>Owner: RALPH MENZIES</p> <p>Address: WHITEVALE RD</p> <p>Area: LUMBY</p> <p>WELL LOCATION: OSOYOOS (ODYD) Land District District Lot: 417 Plan: Lot: Township: Section: Range: Indian Reserve: Meridian: Block: Quarter: Island: BCGS Number (NAD 27): 082L026113 Well: 15</p> <p>Class of Well: Subclass of Well: Orientation of Well: Status of Well: New Well Use: Domestic Observation Well Number: Observation Well Status: Construction Method: Drilled Diameter: 6.0 inches Casing drive shoe: Well Depth: 59 feet Elevation: 0 feet (ASL) Final Casing Stick Up: inches Well Cap Type: Bedrock Depth: feet Lithology Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag:</p> <p>Site Info Details: Other Info Flag: Other Info Details:</p>	<p>Construction Date: 1979-01-01 00:00:00</p> <p>Driller: Thomas Well Drilling Well Identification Plate Number: Plate Attached By: Where Plate Attached:</p> <p>PRODUCTION DATA AT TIME OF DRILLING: Well Yield: 15 (Driller's Estimate) Development Method: Pump Test Info Flag: Artesian Flow: UNKNOWN YIELD Artesian Pressure (ft): Static Level: 38 feet</p> <p>WATER QUALITY: Character: Colour: Odour: Well Disinfected: N EMS ID: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM):</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>SURFACE SEAL: Flag: Material: Method: Depth (ft): Thickness (in):</p> <p>WELL CLOSURE INFORMATION: Reason For Closure: Method of Closure: Closure Sealant Material: Closure Backfill Material: Details of Closure:</p>
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Screen from	to feet	Type	Slot Size
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GENERAL REMARKS:

LITHOLOGY INFORMATION:

From	0 to	4 Ft.	OPEN PIT
From	4 to	50 Ft.	TILL
From	50 to	59 Ft.	WATER-BEARING GRAVEL

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Information Disclaimer

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Report 1 - Detailed Well Record

<p>Well Tag Number: 41509</p> <p>Owner: BILL BREWER</p> <p>Address: WHITEVALE RD</p> <p>Area: LUMBY</p> <p>WELL LOCATION: OSOYOOS (ODYD) Land District District Lot: 417 Plan: 7456 Lot: 1 Township: Section: Range: Indian Reserve: Meridian: Block: Quarter: Island: BCGS Number (NAD 27): 082L026113 Well: 14</p> <p>Class of Well: Subclass of Well: Orientation of Well: Status of Well: New Well Use: Domestic Observation Well Number: Observation Well Status: Construction Method: Drilled Diameter: 6.0 inches Casing drive shoe: Well Depth: 40 feet Elevation: 0 feet (ASL) Final Casing Stick Up: inches Well Cap Type: Bedrock Depth: feet Lithology Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag:</p> <p>Site Info Details: Other Info Flag: Other Info Details:</p>	<p>Construction Date: 1979-01-01 00:00:00</p> <p>Driller: Thomas Well Drilling Well Identification Plate Number: Plate Attached By: Where Plate Attached:</p> <p>PRODUCTION DATA AT TIME OF DRILLING: Well Yield: 20 (Driller's Estimate) Development Method: Pump Test Info Flag: Artesian Flow: UNKNOWN YIELD Artesian Pressure (ft): Static Level: 27 feet</p> <p>WATER QUALITY: Character: Colour: Odour: Well Disinfected: N EMS ID: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM):</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>SURFACE SEAL: Flag: Material: Method: Depth (ft): Thickness (in):</p> <p>WELL CLOSURE INFORMATION: Reason For Closure: Method of Closure: Closure Sealant Material: Closure Backfill Material: Details of Closure:</p>
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Screen from	to feet	Type	Slot Size
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GENERAL REMARKS:

LITHOLOGY INFORMATION:

From	0 to	5 Ft.	OPEN PIT
From	5 to	27 Ft.	TILL
From	27 to	40 Ft.	WATER-BEARING GRAVEL

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Report 1 - Detailed Well Record

<p>Well Tag Number: 43930</p> <p>Owner: MARTIN O`NEIL</p> <p>Address: WHITEVALE RD</p> <p>Area: LUMBY</p> <p>WELL LOCATION: OSOYOOS (ODYD) Land District District Lot: 418 Plan: 3832 Lot: 1 Township: Section: Range: Indian Reserve: Meridian: Block: Quarter: Island: BCGS Number (NAD 27): 082L026113 Well: 26</p> <p>Class of Well: Subclass of Well: Orientation of Well: Status of Well: New Well Use: Unknown Well Use Observation Well Number: Observation Well Status: Construction Method: Drilled Diameter: 6.0 inches Casing drive shoe: Well Depth: 39 feet Elevation: 0 feet (ASL) Final Casing Stick Up: inches Well Cap Type: Bedrock Depth: feet Lithology Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag:</p> <p>Site Info Details: Other Info Flag: Other Info Details:</p>	<p>Construction Date: 1979-12-01 00:00:00</p> <p>Driller: M. Schibli Drilling Well Identification Plate Number: Plate Attached By: Where Plate Attached:</p> <p>PRODUCTION DATA AT TIME OF DRILLING: Well Yield: 5 (Driller's Estimate) Development Method: Pump Test Info Flag: Artesian Flow: UNKNOWN YIELD Artesian Pressure (ft): Static Level: 22 feet</p> <p>WATER QUALITY: Character: Colour: Odour: Well Disinfected: N EMS ID: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM):</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>SURFACE SEAL: Flag: Material: Method: Depth (ft): Thickness (in):</p> <p>WELL CLOSURE INFORMATION: Reason For Closure: Method of Closure: Closure Sealant Material: Closure Backfill Material: Details of Closure:</p>
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Screen from	to feet	Type	Slot Size
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GENERAL REMARKS:

LITHOLOGY INFORMATION:

From	0 to	22 Ft.	EXISTING WELL
From	22 to	24 Ft.	WATER-BEARING GRAVEL
From	24 to	37 Ft.	HARDPAN & GRAVEL LAYERS
From	37 to	38 Ft.	SILTY SAND
From	38 to	39 Ft.	HARD PACKED GRAVEL, WATER-BEARING GRAVEL



Report 1 - Detailed Well Record

<p>Well Tag Number: 44280</p> <p>Owner: STAN COX</p> <p>Address: WHITEVALE RD</p> <p>Area: LUMBY</p> <p>WELL LOCATION: OSOYOOS (ODYD) Land District District Lot: 186 Plan: 10247 Lot: 2 Township: Section: Range: Indian Reserve: Meridian: Block: Quarter: Island: BCGS Number (NAD 27): 082L026113 Well: 17</p> <p>Class of Well: Subclass of Well: Orientation of Well: Status of Well: New Well Use: Domestic Observation Well Number: Observation Well Status: Construction Method: Drilled Diameter: 6.0 inches Casing drive shoe: Well Depth: 32 feet Elevation: 0 feet (ASL) Final Casing Stick Up: inches Well Cap Type: Bedrock Depth: feet Lithology Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag:</p> <p>Site Info Details: Other Info Flag: Other Info Details:</p>	<p>Construction Date: 1980-01-07 00:00:00.0</p> <p>Driller: M. Schibli Drilling Well Identification Plate Number: Plate Attached By: Where Plate Attached:</p> <p>PRODUCTION DATA AT TIME OF DRILLING: Well Yield: 20 (Driller's Estimate) Gallons per Min Development Method: Pump Test Info Flag: Artesian Flow: UNKNOWN YIELD Artesian Pressure (ft): Static Level: 15 feet</p> <p>WATER QUALITY: Character: Colour: Odour: Well Disinfected: N EMS ID: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM):</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>SURFACE SEAL: Flag: Material: Method: Depth (ft): Thickness (in):</p> <p>WELL CLOSURE INFORMATION: Reason For Closure: Method of Closure: Closure Sealant Material: Closure Backfill Material: Details of Closure:</p>
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Screen from	to feet	Type	Slot Size
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GENERAL REMARKS:

LITHOLOGY INFORMATION:

From	0 to	13 Ft.	EXISTING WELL
From	13 to	32 Ft.	GRAVEL & SAND, WATER

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Report 1 - Detailed Well Record

<p>Well Tag Number: 44295</p> <p>Owner: JOE WALLACE</p> <p>Address: WHITEVALE RD</p> <p>Area: LUMBY</p> <p>WELL LOCATION: OSOYOOS (ODYD) Land District District Lot: Plan: 11536 Lot: 1 Township: 3 Section: 15 Range: Indian Reserve: Meridian: Block: Quarter: Island: BCGS Number (NAD 27): 082L026113 Well: 24</p> <p>Class of Well: Subclass of Well: Orientation of Well: Status of Well: New Well Use: Domestic Observation Well Number: Observation Well Status: Construction Method: Drilled Diameter: 0.0 inches Casing drive shoe: Well Depth: 38 feet Elevation: 0 feet (ASL) Final Casing Stick Up: inches Well Cap Type: Bedrock Depth: feet Lithology Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag:</p> <p>Site Info Details: Other Info Flag: Other Info Details:</p>	<p>Construction Date: 1980-01-13 00:00:00</p> <p>Driller: Thomas Well Drilling Well Identification Plate Number: Plate Attached By: Where Plate Attached:</p> <p>PRODUCTION DATA AT TIME OF DRILLING: Well Yield: 30 (Driller's Estimate) Development Method: Pump Test Info Flag: Artesian Flow: UNKNOWN YIELD Artesian Pressure (ft): Static Level: 23 feet</p> <p>WATER QUALITY: Character: Colour: Odour: Well Disinfected: N EMS ID: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM):</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>SURFACE SEAL: Flag: Material: Method: Depth (ft): Thickness (in):</p> <p>WELL CLOSURE INFORMATION: Reason For Closure: Method of Closure: Closure Sealant Material: Closure Backfill Material: Details of Closure:</p>
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Screen from	to feet	Type	Slot Size
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GENERAL REMARKS:			
LITHOLOGY INFORMATION:			
From	0 to	23 Ft.	DUG HOLE
From	23 to	38 Ft.	WATER-BEARING GRAVEL

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Report 1 - Detailed Well Record

<p>Well Tag Number: 47806</p> <p>Owner: HENRY TEICHROEB</p> <p>Address: WHITEVALE RD</p> <p>Area: LUMBY</p> <p>WELL LOCATION: OSOYOOS (ODYD) Land District District Lot: 186 Plan: 10247 Lot: 4 Township: Section: Range: Indian Reserve: Meridian: Block: Quarter: Island: BCGS Number (NAD 27): 082L026113 Well: 16</p> <p>Class of Well: Subclass of Well: Orientation of Well: Status of Well: New Well Use: Domestic Observation Well Number: Observation Well Status: Construction Method: Drilled Diameter: 6.0 inches Casing drive shoe: Well Depth: 66 feet Elevation: 0 feet (ASL) Final Casing Stick Up: inches Well Cap Type: Bedrock Depth: feet Lithology Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag:</p> <p>Site Info Details: Other Info Flag: Other Info Details:</p>	<p>Construction Date: 1981-04-30 00:00:00</p> <p>Driller: Thomas Well Drilling Well Identification Plate Number: Plate Attached By: Where Plate Attached:</p> <p>PRODUCTION DATA AT TIME OF DRILLING: Well Yield: 15 (Driller's Estimate) Development Method: Pump Test Info Flag: Artesian Flow: UNKNOWN YIELD Artesian Pressure (ft): Static Level: 0 feet</p> <p>WATER QUALITY: Character: Colour: Odour: Well Disinfected: N EMS ID: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM):</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>SURFACE SEAL: Flag: Material: Method: Depth (ft): Thickness (in):</p> <p>WELL CLOSURE INFORMATION: Reason For Closure: Method of Closure: Closure Sealant Material: Closure Backfill Material: Details of Closure:</p>
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Screen from	to feet	Type	Slot Size
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GENERAL REMARKS:

LITHOLOGY INFORMATION:

From	0 to	7 Ft.	TOPSOIL
From	7 to	10 Ft.	SANDY GRAVEL DRY
From	10 to	14 Ft.	SAND & GRAVEL
From	14 to	20 Ft.	WATER-BEARING SAND & GRAVEL
From	20 to	35 Ft.	DRY GRAVELLY TILL
From	35 to	48 Ft.	CLAY
From	48 to	66 Ft.	WATER-BEARING SAND & GRAVEL



Report 1 - Detailed Well Record

<p>Well Tag Number: 54469</p> <p>Owner: SMIT</p> <p>Address: WHITEVALE RD</p> <p>Area: LUMBY</p> <p>WELL LOCATION: OSOYOOS (ODYD) Land District District Lot: 186 Plan: Lot: Township: Section: Range: Indian Reserve: Meridian: Block: Quarter: Island: BCGS Number (NAD 27): 082L026113 Well: 22</p> <p>Class of Well: Subclass of Well: Orientation of Well: Status of Well: New Well Use: Domestic Observation Well Number: Observation Well Status: Construction Method: Drilled Diameter: 6.0 inches Casing drive shoe: Well Depth: 40 feet Elevation: 0 feet (ASL) Final Casing Stick Up: inches Well Cap Type: Bedrock Depth: feet Lithology Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag:</p> <p>Site Info Details: Other Info Flag: Other Info Details:</p>	<p>Construction Date: 1985-01-01 00:00:00.0</p> <p>Driller: Thomas Well Drilling Well Identification Plate Number: Plate Attached By: Where Plate Attached:</p> <p>PRODUCTION DATA AT TIME OF DRILLING: Well Yield: 30 (Driller's Estimate) Gallons per Min Development Method: Pump Test Info Flag: Artesian Flow: UNKNOWN YIELD Artesian Pressure (ft): Static Level: 20 feet</p> <p>WATER QUALITY: Character: Colour: Odour: Well Disinfected: N EMS ID: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM):</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>SURFACE SEAL: Flag: Material: Method: Depth (ft): Thickness (in):</p> <p>WELL CLOSURE INFORMATION: Reason For Closure: Method of Closure: Closure Sealant Material: Closure Backfill Material: Details of Closure:</p>																				
<table border="1"> <thead> <tr> <th>Screen from</th> <th>to feet</th> <th>Type</th> <th>Slot Size</th> </tr> </thead> <tbody> <tr> <td colspan="4">GENERAL REMARKS:</td> </tr> <tr> <td colspan="4">LITHOLOGY INFORMATION:</td> </tr> <tr> <td>From</td> <td>0 to</td> <td>20 Ft.</td> <td>DUG WELL</td> </tr> <tr> <td>From</td> <td>20 to</td> <td>40 Ft.</td> <td>WATER-BEARING GRAVEL</td> </tr> </tbody> </table>		Screen from	to feet	Type	Slot Size	GENERAL REMARKS:				LITHOLOGY INFORMATION:				From	0 to	20 Ft.	DUG WELL	From	20 to	40 Ft.	WATER-BEARING GRAVEL
Screen from	to feet	Type	Slot Size																		
GENERAL REMARKS:																					
LITHOLOGY INFORMATION:																					
From	0 to	20 Ft.	DUG WELL																		
From	20 to	40 Ft.	WATER-BEARING GRAVEL																		

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Report 1 - Detailed Well Record

<p>Well Tag Number: 57246</p> <p>Owner: BOB FERGUSON</p> <p>Address: GORDON RD</p> <p>Area: LUMBY</p> <p>WELL LOCATION: OSOYOOS (ODYD) Land District District Lot: 417 Plan: 26993 Lot: 9 Township: Section: Range: Indian Reserve: Meridian: Block: Quarter: Island: BCGS Number (NAD 27): 082L026113 Well: 29</p> <p>Class of Well: Subclass of Well: Orientation of Well: Status of Well: New Well Use: Domestic Observation Well Number: Observation Well Status: Construction Method: Drilled Diameter: 7.0 inches Casing drive shoe: Well Depth: 58 feet Elevation: 0 feet (ASL) Final Casing Stick Up: inches Well Cap Type: Bedrock Depth: feet Lithology Info Flag: N File Info Flag: N Sieve Info Flag: N Screen Info Flag: N</p> <p>Site Info Details: Other Info Flag: Other Info Details:</p>	<p>Construction Date: 1987-07-09 00:00:00</p> <p>Driller: Dan Gare Drilling Well Identification Plate Number: Plate Attached By: Where Plate Attached:</p> <p>PRODUCTION DATA AT TIME OF DRILLING: Well Yield: 30 (Driller's Estimate) Development Method: Pump Test Info Flag: N Artesian Flow: UNKNOWN YIELD Artesian Pressure (ft): Static Level: 34 feet</p> <p>WATER QUALITY: Character: Colour: Odour: Well Disinfected: N EMS ID: Water Chemistry Info Flag: N Field Chemistry Info Flag: Site Info (SEAM): N</p> <p>Water Utility: N Water Supply System Name: Water Supply System Well Name:</p> <p>SURFACE SEAL: Flag: N Material: Method: Depth (ft): Thickness (in):</p> <p>WELL CLOSURE INFORMATION: Reason For Closure: Method of Closure: Closure Sealant Material: Closure Backfill Material: Details of Closure:</p>
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Screen from	to feet	Type	Slot Size
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GENERAL REMARKS:

LITHOLOGY INFORMATION:
From 0 to 6 Ft. DIRT & GRAVEL
From 6 to 58 Ft. GRAVEL & SAND

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Report 1 - Detailed Well Record

<p>Well Tag Number: 57774</p> <p>Owner: JOHN MCDONOUGH</p> <p>Address: WHITEVALE RD</p> <p>Area: LUMBY</p> <p>WELL LOCATION: OSOYOOS (ODYD) Land District District Lot: Plan: 32257 Lot: 1 Township: 3 Section: 15 Range: Indian Reserve: Meridian: Block: Quarter: Island: BCGS Number (NAD 27): 082L026113 Well: 28</p> <p>Class of Well: Subclass of Well: Orientation of Well: Status of Well: New Well Use: Domestic Observation Well Number: Observation Well Status: Construction Method: Drilled Diameter: 5.0 inches Casing drive shoe: Well Depth: 62 feet Elevation: 0 feet (ASL) Final Casing Stick Up: inches Well Cap Type: Bedrock Depth: feet Lithology Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag:</p> <p>Site Info Details: Other Info Flag: Other Info Details:</p>	<p>Construction Date: 1987-12-06 00:00:00</p> <p>Driller: M. Schibli Drilling Well Identification Plate Number: Plate Attached By: Where Plate Attached:</p> <p>PRODUCTION DATA AT TIME OF DRILLING: Well Yield: 60 (Driller's Estimate) Development Method: Pump Test Info Flag: Artesian Flow: UNKNOWN YIELD Artesian Pressure (ft): Static Level: 20 feet</p> <p>WATER QUALITY: Character: Colour: Odour: Well Disinfected: N EMS ID: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM):</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>SURFACE SEAL: Flag: Material: Method: Depth (ft): Thickness (in):</p> <p>WELL CLOSURE INFORMATION: Reason For Closure: Method of Closure: Closure Sealant Material: Closure Backfill Material: Details of Closure:</p>
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Screen from	to feet	Type	Slot Size
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GENERAL REMARKS:

LITHOLOGY INFORMATION:

From	0 to	21 Ft.	BROWN SAND & GRAVEL, FINE TO COARSE
From	21 to	56 Ft.	BROWN CLAYEY SAND & GRAVEL WITH COBBLES
From	0 to	0 Ft.	FINE TO COARSE.
From	56 to	62 Ft.	BROWN SAND & GRAVEL, FINE TO MEDIUM, CLEAN

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Report 1 - Detailed Well Record

<p>Well Tag Number: 58436</p> <p>Owner: CECIL STENQUIST</p> <p>Address: POWELL RD</p> <p>Area: LUMBY</p> <p>WELL LOCATION: OSOYOOS (ODYD) Land District District Lot: 417 Plan: 23924 Lot: 6 Township: Section: Range: Indian Reserve: Meridian: Block: Quarter: Island: BCGS Number (NAD 27): 082L026113 Well: 30</p> <p>Class of Well: Subclass of Well: Orientation of Well: Status of Well: New Well Use: Domestic Observation Well Number: Observation Well Status: Construction Method: Drilled Diameter: 5.0 inches Casing drive shoe: Well Depth: 56 feet Elevation: 0 feet (ASL) Final Casing Stick Up: inches Well Cap Type: Bedrock Depth: feet Lithology Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag:</p> <p>Site Info Details: Other Info Flag: Other Info Details:</p>	<p>Construction Date: 1988-09-21 00:00:00</p> <p>Driller: M. Schibli Drilling Well Identification Plate Number: Plate Attached By: Where Plate Attached:</p> <p>PRODUCTION DATA AT TIME OF DRILLING: Well Yield: 20 (Driller's Estimate) Development Method: Pump Test Info Flag: Artesian Flow: UNKNOWN YIELD Artesian Pressure (ft): Static Level: 24 feet</p> <p>WATER QUALITY: Character: Colour: Odour: Well Disinfected: N EMS ID: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM):</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>SURFACE SEAL: Flag: Material: Method: Depth (ft): Thickness (in):</p> <p>WELL CLOSURE INFORMATION: Reason For Closure: Method of Closure: Closure Sealant Material: Closure Backfill Material: Details of Closure:</p>
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Screen from	to feet	Type	Slot Size
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GENERAL REMARKS:

LITHOLOGY INFORMATION:
From 0 to 56 Ft. BROWN SAND & GRAVEL, FINE TO MEDIUM SOME
From 0 to 0 Ft. COBBLES.

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Report 1 - Detailed Well Record

<p>Well Tag Number: 62592</p> <p>Owner: DARRELL & A CHAREST</p> <p>Address: WHITE VALE ROAD</p> <p>Area: LUMBY</p> <p>WELL LOCATION: OSOYOOS (ODYD) Land District District Lot: Plan: 26632 Lot: A Township: 3 Section: 15 Range: Indian Reserve: Meridian: Block: Quarter: Island: BCGS Number (NAD 27): 082L026113 Well: 31</p> <p>Class of Well: Subclass of Well: Orientation of Well: Status of Well: New Well Use: Domestic Observation Well Number: Observation Well Status: Construction Method: Drilled Diameter: 0.0 inches Casing drive shoe: Well Depth: 58 feet Elevation: 0 feet (ASL) Final Casing Stick Up: inches Well Cap Type: Bedrock Depth: feet Lithology Info Flag: N File Info Flag: N Sieve Info Flag: N Screen Info Flag: N</p> <p>Site Info Details: Other Info Flag: Other Info Details:</p>	<p>Construction Date: 1992-08-31 00:00:00</p> <p>Driller: Dan Gare Drilling Well Identification Plate Number: Plate Attached By: Where Plate Attached:</p> <p>PRODUCTION DATA AT TIME OF DRILLING: Well Yield: 80 (Driller's Estimate) Development Method: Pump Test Info Flag: Y Artesian Flow: 0 UNKNOWN YIELD Artesian Pressure (ft): Static Level: 30 feet</p> <p>WATER QUALITY: Character: Colour: Odour: Well Disinfected: N EMS ID: Water Chemistry Info Flag: N Field Chemistry Info Flag: Site Info (SEAM): N</p> <p>Water Utility: N Water Supply System Name: Water Supply System Well Name:</p> <p>SURFACE SEAL: Flag: N Material: Method: Depth (ft): 0 feet Thickness (in): Liner from To: feet</p> <p>WELL CLOSURE INFORMATION: Reason For Closure: Method of Closure: Closure Sealant Material: Closure Backfill Material: Details of Closure:</p>
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Screen from	to feet	Type	Slot Size
0	0		0
0	0		0
0	0		0
0	0		0

GENERAL REMARKS:

LITHOLOGY INFORMATION:

From	0 to	25 Ft.	Clay & rocks
From	25 to	52 Ft.	Sand, gravel & silt
From	52 to	58 Ft.	Sand & gravel



Report 1 - Detailed Well Record

<p>Well Tag Number: 75652</p> <p>Owner: NORTH OKANAGAN REGIONAL DISTRICT</p> <p>Address: 715 FRANKLYN ROAD</p> <p>Area: WHITEVALE</p> <p>WELL LOCATION: OSOYOOS (ODYD) Land District District Lot: 418 Plan: 19560 Lot: 24 Township: Section: Range: Indian Reserve: Meridian: Block: Quarter: Island: BCGS Number (NAD 27): 082L026113 Well: 32</p> <p>Class of Well: Subclass of Well: Orientation of Well: Status of Well: New Well Use: Drinking Water Supply System Observation Well Number: Observation Well Status: Construction Method: Drilled Diameter: inches Casing drive shoe: Well Depth: 68 feet Elevation: 1702.8 feet (ASL) Final Casing Stick Up: inches Well Cap Type: Bedrock Depth: feet Lithology Info Flag: Y File Info Flag: N Sieve Info Flag: N Screen Info Flag: N</p> <p>Site Info Details: Other Info Flag: Other Info Details:</p>	<p>Construction Date: 1969-06-15 00:00:00</p> <p>Driller: Okanagan Rotary Well Drilling Well Identification Plate Number: 1002 Plate Attached By: CHRIS YOUNG Where Plate Attached: WELL CAP</p> <p>PRODUCTION DATA AT TIME OF DRILLING: Well Yield: (Driller's Estimate) Development Method: Pump Test Info Flag: Y Artesian Flow: 0 UNKNOWN YIELD Artesian Pressure (ft): Static Level: 21 feet</p> <p>WATER QUALITY: Character: Colour: Odour: Well Disinfected: N EMS ID: E241101 Water Chemistry Info Flag: Y Field Chemistry Info Flag: Site Info (SEAM): N</p> <p>Water Utility: N Water Supply System Name: WHITEVALE UI Water Supply System Well Name:</p> <p>SURFACE SEAL: Flag: N Material: Method: Depth (ft): 0 feet Thickness (in):</p> <p>WELL CLOSURE INFORMATION: Reason For Closure: Method of Closure: Closure Sealant Material: Closure Backfill Material: Details of Closure:</p>
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Screen from	to feet	Type	Slot Size
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<p>GENERAL REMARKS: VALOUCH VALE SUBDIVISION.</p> <p>LITHOLOGY INFORMATION:</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%;">From</td> <td style="width: 10%;">0 to</td> <td style="width: 10%;">5 Ft.</td> <td>BROWN CLAY</td> </tr> <tr> <td>From</td> <td>5 to</td> <td>20 Ft.</td> <td>BROWN SANDY CLAY WITH ROCKS</td> </tr> <tr> <td>From</td> <td>20 to</td> <td>32 Ft.</td> <td>HARDPAN (TILL?)</td> </tr> <tr> <td>From</td> <td>32 to</td> <td>36 Ft.</td> <td>SOFT SANDY CLAY WITH ROCKS</td> </tr> <tr> <td>From</td> <td>36 to</td> <td>44 Ft.</td> <td>SAND WITH STONES</td> </tr> <tr> <td>From</td> <td>44 to</td> <td>68 Ft.</td> <td>VERY COARSE CLEAN GRAVEL</td> </tr> <tr> <td>From</td> <td>to</td> <td>Ft.</td> <td>PUMP TEST SHOWS WELL CAPACITY IS HIGHER THAN 53 IGPM; F</td> </tr> </table>	From	0 to	5 Ft.	BROWN CLAY	From	5 to	20 Ft.	BROWN SANDY CLAY WITH ROCKS	From	20 to	32 Ft.	HARDPAN (TILL?)	From	32 to	36 Ft.	SOFT SANDY CLAY WITH ROCKS	From	36 to	44 Ft.	SAND WITH STONES	From	44 to	68 Ft.	VERY COARSE CLEAN GRAVEL	From	to	Ft.	PUMP TEST SHOWS WELL CAPACITY IS HIGHER THAN 53 IGPM; F
From	0 to	5 Ft.	BROWN CLAY																									
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From	to	Ft.	PUMP TEST SHOWS WELL CAPACITY IS HIGHER THAN 53 IGPM; F																									



Report 1 - Detailed Well Record

<p>Well Tag Number: 80349</p> <p>Owner: WAYNE SMIT</p> <p>Address: 432 WHITEVALE RD</p> <p>Area: LUMBY</p> <p>WELL LOCATION: OSOYOOS (ODYD) Land District District Lot: 186 Plan: Lot: Township: Section: Range: Indian Reserve: Meridian: Block: Quarter: Island: BCGS Number (NAD 27): 082L026113 Well: 33</p> <p>Class of Well: Subclass of Well: Orientation of Well: Status of Well: New Well Use: Domestic Observation Well Number: Observation Well Status: Construction Method: Diameter: 6 inches Casing drive shoe: Well Depth: 58 feet Elevation: feet (ASL) Final Casing Stick Up: inches Well Cap Type: Bedrock Depth: feet Lithology Info Flag: Y File Info Flag: N Sieve Info Flag: N Screen Info Flag: Y</p> <p>Site Info Details: Other Info Flag: Other Info Details:</p>	<p>Construction Date: 1995-09-25 00:00:00</p> <p>Driller: M. Schibli Drilling Well Identification Plate Number: Plate Attached By: Where Plate Attached:</p> <p>PRODUCTION DATA AT TIME OF DRILLING: Well Yield: 30 (Driller's Estimate) Development Method: Pump Test Info Flag: N Artesian Flow: UNKNOWN YIELD Artesian Pressure (ft): Static Level: 16 feet</p> <p>WATER QUALITY: Character: Colour: Odour: Well Disinfected: N EMS ID: Water Chemistry Info Flag: N Field Chemistry Info Flag: Site Info (SEAM): N</p> <p>Water Utility: N Water Supply System Name: Water Supply System Well Name:</p> <p>SURFACE SEAL: Flag: N Material: Method: Depth (ft): Thickness (in):</p> <p>WELL CLOSURE INFORMATION: Reason For Closure: Method of Closure: Closure Sealant Material: Closure Backfill Material: Details of Closure:</p>
--	--

Screen from	to feet	Type	Slot Size
54	58		30

GENERAL REMARKS:
PITLESS ADAPTOR INSTALLED

LITHOLOGY INFORMATION:

From	to	Ft.	Lithology
From	0 to	6 Ft.	BROWN SANDY LOAM SOIL
From	6 to	22 Ft.	BROWN SAND & GRAVEL W SILTY CLAY LAYERS
From	22 to	26 Ft.	BROWN SILTY CLAY
From	26 to	35 Ft.	BROWN SILTY CLAY W GRAVEL LAYERS
From	35 to	58 Ft.	BROWN SAND GRAVEL & COBBLES



Report 1 - Detailed Well Record

<p>Well Tag Number: 82422</p> <p>Owner: WYNE MCKAY</p> <p>Address: 471 WHITEVALE RD</p> <p>Area: LUMBY</p> <p>WELL LOCATION: OSOYOOS (ODYD) Land District District Lot: Plan: 32257 Lot: 2 Township: 3 Section: 15 Range: Indian Reserve: Meridian: Block: Quarter: Island: BCGS Number (NAD 27): 082L026113 Well: 35</p> <p>Class of Well: Subclass of Well: Orientation of Well: Status of Well: New Well Use: Domestic Observation Well Number: Observation Well Status: Construction Method: Drilled Diameter: 6.00 inches Casing drive shoe: Well Depth: 42 feet Elevation: feet (ASL) Final Casing Stick Up: inches Well Cap Type: Bedrock Depth: feet Lithology Info Flag: Y File Info Flag: N Sieve Info Flag: N Screen Info Flag: N</p> <p>Site Info Details: Other Info Flag: Other Info Details:</p>	<p>Construction Date: 1981-04-25 00:00:00.0</p> <p>Driller: Thomas Well Drilling Well Identification Plate Number: Plate Attached By: Where Plate Attached:</p> <p>PRODUCTION DATA AT TIME OF DRILLING: Well Yield: (Driller's Estimate) UN Development Method: Pump Test Info Flag: N Artesian Flow: UNKNOWN YIELD Artesian Pressure (ft): Static Level: 23 feet</p> <p>WATER QUALITY: Character: Colour: Odour: Well Disinfected: N EMS ID: Water Chemistry Info Flag: N Field Chemistry Info Flag: Site Info (SEAM): N</p> <p>Water Utility: N Water Supply System Name: Water Supply System Well Name:</p> <p>SURFACE SEAL: Flag: N Material: Method: Depth (ft): Thickness (in):</p> <p>WELL CLOSURE INFORMATION: Reason For Closure: Method of Closure: Closure Sealant Material: Closure Backfill Material: Details of Closure:</p>
--	---

Screen from	to feet	Type	Slot Size
<p>GENERAL REMARKS: CASING: WELDED; SHOE: 1</p> <p>LITHOLOGY INFORMATION: From 6 to 14 Ft. ROCK & SAND From 14 to 22 Ft. ROCKS & GRAVELY SAND From 22 to 31 Ft. SAND & GRAVEL WITH WATER From 31 to 36 Ft. DRY HARD GRAVEL</p>			

From	36	to	41	Ft.	W B GRAVEL
From	41	to	43	Ft.	W B SAND
From	0	to	3	Ft.	TOPSOIL
From	3	to	6	Ft.	GRAVEL & ROCKS

- [Return to Main](#)

Information Disclaimer

The Province disclaims all responsibility for the accuracy of information provided. Information provided should not be used as a basis for making financial or any other commitments.



Report 1 - Detailed Well Record

<p>Well Tag Number: 82423</p> <p>Owner: GROMOW</p> <p>Address: WHITEVALE RD</p> <p>Area: LUMBY</p> <p>WELL LOCATION: OSOYOOS (ODYD) Land District District Lot: Plan: 32257 Lot: 3 Township: 3 Section: 15 Range: Indian Reserve: Meridian: Block: Quarter: Island: BCGS Number (NAD 27): 082L026113 Well: 34</p> <p>Class of Well: Subclass of Well: Orientation of Well: Status of Well: New Well Use: Domestic Observation Well Number: Observation Well Status: Construction Method: Drilled Diameter: 6.00 inches Casing drive shoe: Well Depth: 41 feet Elevation: feet (ASL) Final Casing Stick Up: inches Well Cap Type: Bedrock Depth: feet Lithology Info Flag: Y File Info Flag: N Sieve Info Flag: N Screen Info Flag: N</p> <p>Site Info Details: Other Info Flag: Other Info Details:</p>	<p>Construction Date: 1981-04-01 00:00:00.0</p> <p>Driller: Thomas Well Drilling Well Identification Plate Number: Plate Attached By: Where Plate Attached:</p> <p>PRODUCTION DATA AT TIME OF DRILLING: Well Yield: 11 (Driller's Estimate) Ga Development Method: Pump Test Info Flag: N Artesian Flow: UNKNOWN YIELD Artesian Pressure (ft): Static Level: 20 feet</p> <p>WATER QUALITY: Character: Colour: Odour: Well Disinfected: N EMS ID: Water Chemistry Info Flag: N Field Chemistry Info Flag: Site Info (SEAM): N</p> <p>Water Utility: N Water Supply System Name: Water Supply System Well Name:</p> <p>SURFACE SEAL: Flag: N Material: Method: Depth (ft): Thickness (in):</p> <p>WELL CLOSURE INFORMATION: Reason For Closure: Method of Closure: Closure Sealant Material: Closure Backfill Material: Details of Closure:</p>
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Screen from	to feet	Type	Slot Size
<p>GENERAL REMARKS: CAPPED</p> <p>LITHOLOGY INFORMATION: From 0 to 2 Ft. TOPSOIL From 2 to 5 Ft. ROCKS & GRAVEL From 5 to 11 Ft. GRAVEL & SAND From 11 to 24 Ft. SAND WITH A FEW ROCKS</p>			

GENERAL REMARKS:

CAPPED

LITHOLOGY INFORMATION:

From	0 to	2 Ft.	TOPSOIL
From	2 to	5 Ft.	ROCKS & GRAVEL
From	5 to	11 Ft.	GRAVEL & SAND
From	11 to	24 Ft.	SAND WITH A FEW ROCKS

From	24	to	30 Ft.	W B SAND
From	30	to	35 Ft.	DRY SAND & GRAVEL
From	36	to	42 Ft.	W B GRAVEL
From	42	to	44 Ft.	W B SAND

- [Return to Main](#)

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Report 1 - Detailed Well Record

<p>Well Tag Number: 82512</p> <p>Owner: SIEGMUELLER</p> <p>Address:</p> <p>Area: LUMBY</p> <p>WELL LOCATION: OSOYOOS (ODYD) Land District District Lot: 418 Plan: Lot: Township: Section: Range: Indian Reserve: Meridian: Block: Quarter: Island: BCGS Number (NAD 27): 082L026131 Well: 23</p> <p>Class of Well: Subclass of Well: Orientation of Well: Status of Well: New Well Use: Domestic Observation Well Number: Observation Well Status: Construction Method: Drilled Diameter: 6 inches Casing drive shoe: Well Depth: 42 feet Elevation: feet (ASL) Final Casing Stick Up: inches Well Cap Type: Bedrock Depth: feet Lithology Info Flag: Y File Info Flag: N Sieve Info Flag: N Screen Info Flag: Y</p> <p>Site Info Details: Other Info Flag: Other Info Details:</p>	<p>Construction Date: 1992-11-24 00:00:00.0</p> <p>Driller: M. Schibli Drilling Well Identification Plate Number: Plate Attached By: Where Plate Attached:</p> <p>PRODUCTION DATA AT TIME OF DRILLING: Well Yield: (Driller's Estimate) U.S. Gallons pe Development Method: Pump Test Info Flag: N Artesian Flow: UNKNOWN YIELD Artesian Pressure (ft): Static Level: 10 feet</p> <p>WATER QUALITY: Character: Colour: Odour: Well Disinfected: N EMS ID: Water Chemistry Info Flag: N Field Chemistry Info Flag: Site Info (SEAM): N</p> <p>Water Utility: N Water Supply System Name: Water Supply System Well Name:</p> <p>SURFACE SEAL: Flag: N Material: Method: Depth (ft): Thickness (in):</p> <p>WELL CLOSURE INFORMATION: Reason For Closure: Method of Closure: Closure Sealant Material: Closure Backfill Material: Details of Closure:</p>								
<table border="1"> <thead> <tr> <th>Screen from</th> <th>to feet</th> <th>Type</th> <th>Slot Size</th> </tr> </thead> <tbody> <tr> <td>38</td> <td>42</td> <td></td> <td>30</td> </tr> </tbody> </table>	Screen from	to feet	Type	Slot Size	38	42		30	
Screen from	to feet	Type	Slot Size						
38	42		30						
<p>GENERAL REMARKS: CAPPED.</p> <p>LITHOLOGY INFORMATION: From 0 to 3 Ft. BROWN CLAY LOAM From 3 to 42 Ft. BROWN SAND & GRAVEL WITH SILTY LENSES</p>									

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Information Disclaimer

APPENDIX III

**BC MOE CONTAMINATED SITE REGISTRY DATABASE
SEARCH, OCTOBER 31, 2007**

As Of: OCT 23, 2007

BC Online: Site Registry

07/10/31

For: PE92096 GOLDER ASSOCIATES LTD. (KELOWNA)

11:22:14

Folio:

Page 1

Area Nil Search

As of OCT 23, 2007, no records from Site Registry
fall within 0.5 kilometers of coordinates
Latitude 50 degrees, 13 minutes, 14.2 seconds, and
Longitude 118 degrees, 59 minutes, 44 seconds.

You have been charged for this information.

Sites may be revealed by searching with alternate search methods. For example,
a site not revealed in an Area search may be revealed by searching with another
piece of information such as PID, PIN, address or Crown Lands File Number

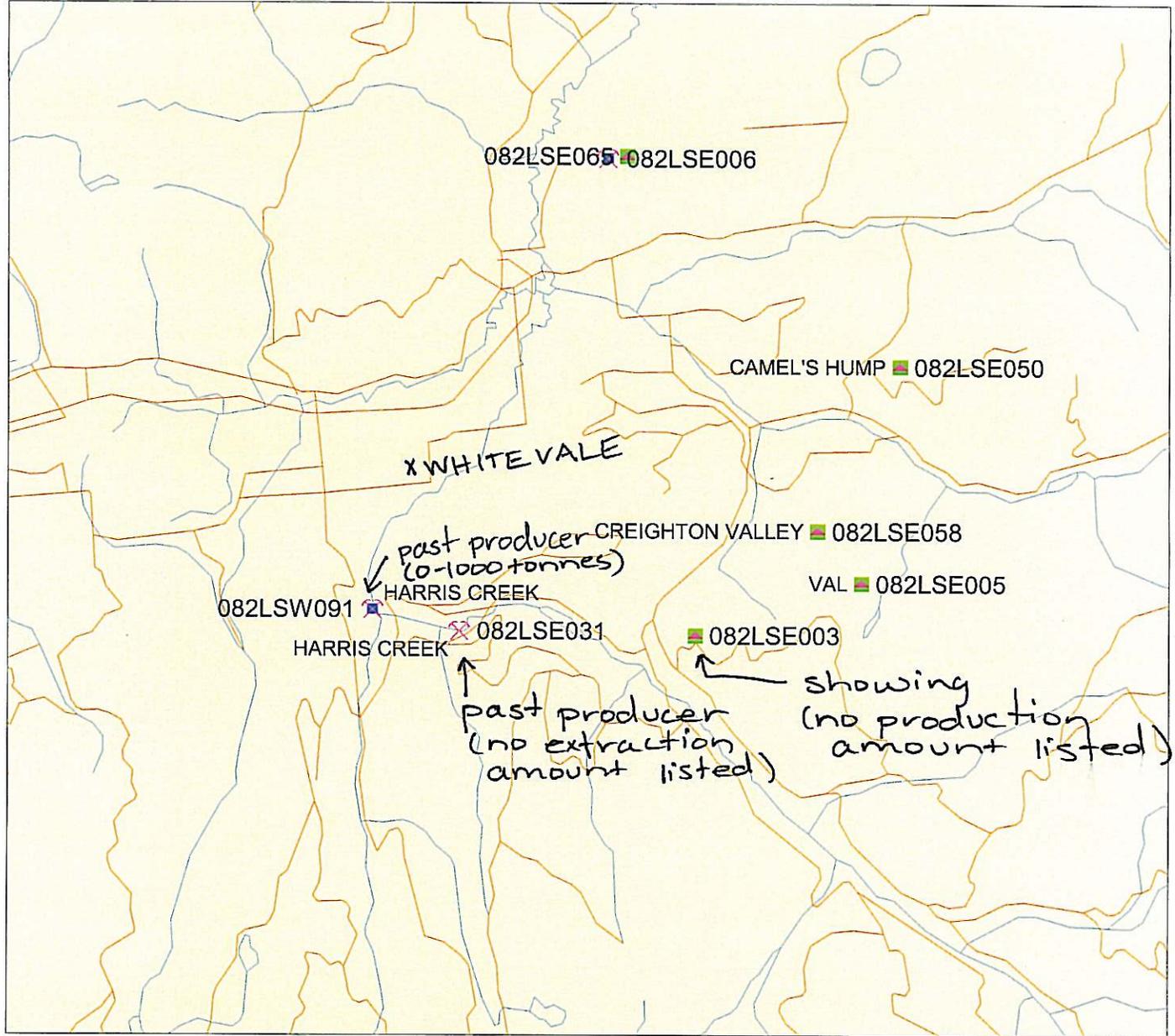
APPENDIX IV

MINERAL ACTIVITY MAP FOR THE WHITEVALE AREA

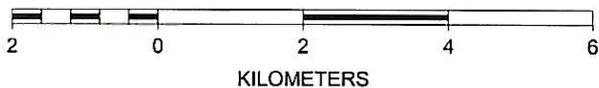
BCGS Geology

Mineral Inventory Layers

- ✕ ... ▲ **MINFILE status**
✕ Producer
✕ Past Producer
✕ Developed Prospect
▲ Prospect
▲ Showing
■ All Others
- ✕ ... ✕ **MINFILE as Producer**
✕ Producer
- ✕ ... ✕ **MINFILE as Past Producer**
✕ Past Producer
- ✕ ... ✕ **MINFILE as Developed Prospect**
✕ Developed Prospect
- ▲ ... ▲ **MINFILE as Prospect**
▲ Prospect
- ▲ ... ▲ **MINFILE as Showing**
▲ Showing
- ✕ ... ■ **MINFILE number label**
✕ Developed Prospect
✕ Past Producer
✕ Producer
■ Prospect
■ Showing
■ All Others
- ✕ ... ■ **MINFILE name label**
✕ Developed Prospect
✕ Past Producer
✕ Producer
■ Prospect
■ Showing
■ All Others
- ... ■ **MINFILE historic production**
■ 0 - 1000 Tonnes
■ 1000 - 5000 T



SCALE 1 : 103,459



Mining Activity
- Current and Historical



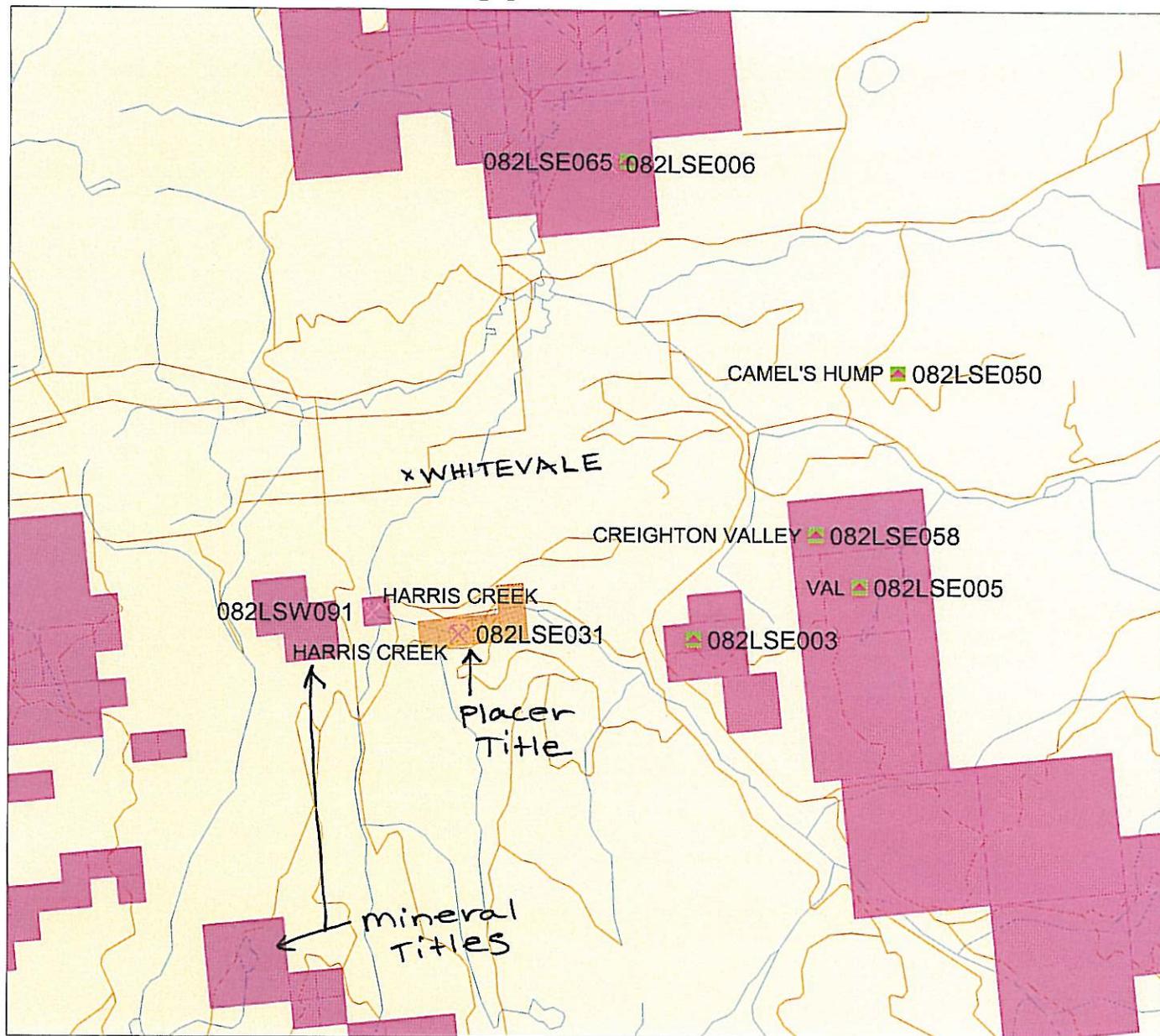
BCGS Geology

Mineral Inventory Layers

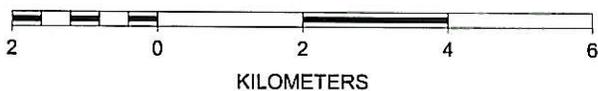
- MINFILE status**
 Producer
 Past Producer
 Developed Prospect
 Prospect
 Showing
 All Others
- MINFILE as Producer**
 Producer
- MINFILE as Past Producer**
 Past Producer
- MINFILE as Developed Prospect**
 Developed Prospect
- MINFILE as Prospect**
 Prospect
- MINFILE as Showing**
 Showing
- MINFILE number label**
 Developed Prospect
 Past Producer
 Producer
 Prospect
 Showing
 All Others
- MINFILE name label**
 Developed Prospect
 Past Producer
 Producer
 Prospect
 Showing
 All Others

Mineral Titles Layers

- MTO Mineral Titles Online solid**



SCALE 1 : 103,745



Mineral Titles



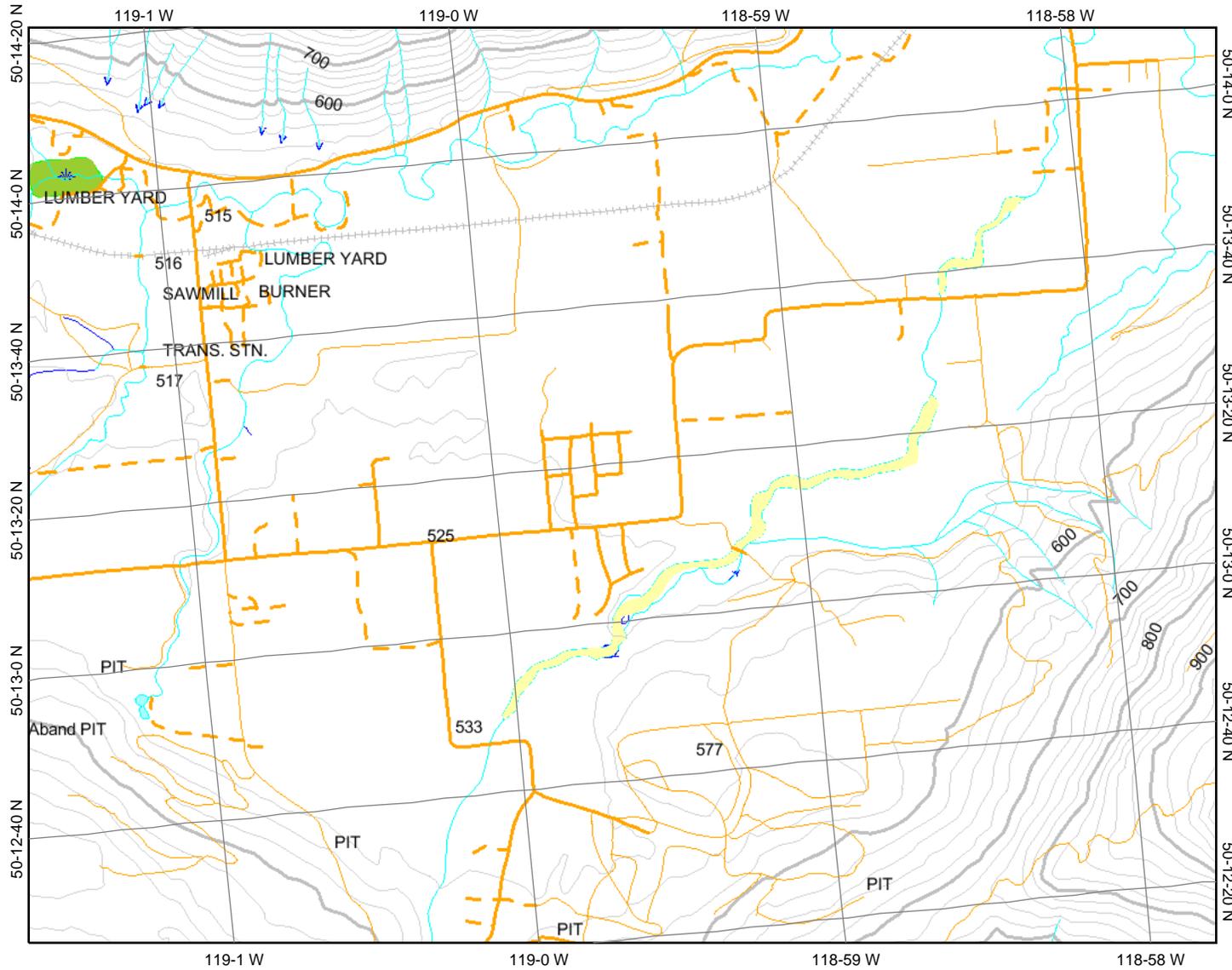
APPENDIX V

**AGRICULTURAL LAND RESERVE MAP
FOR THE WHITEVALE AREA**

APPENDIX VI

**INDUSTRIAL LAND USE IN THE WHITEVALE
AND SURROUNDING AREAS**

Whitevale



0 750 1500 2250 m.

Map center: 50° 13' 17" N, 118° 59' 35" W



Legend

Contours (TRIM)

- Contour - Index
- Contour - Index.Indefinite
- Contour - Index.Depression
- Contour - Index.Depression Indefinite
- Contour - Intermediate
- Contour - Intermediate.Indefinite
- Contour - Intermediate.Depression
- Contour - Intermediate.Depression Indefinite

- Area of Exclusion
- Area of Indefinite Contours

Transportation - Points (TRIM)

- Helipad

Transportation - Lines (TRIM)

- Airfield
- Airport
- Airstrip
- Airport.Abandoned
- Ferry Route
- Road (Gravel Undivided) - 1 Lane
- Road (Gravel Undivided) - 2 Lanes
- Road (Gravel Undivided) - U/C - 1 Lane
- Road (Gravel Undivided) - U/C - 2 Lanes
- Road (Paved Divided) - Not Elevated - 1 Lane Each Way
- Road (Paved Divided) - Not Elevated - 2 Lanes Each Way
- Road (Paved Divided) - U/C - Not Elevated - 2 Lanes Each Way
- Road (Paved Undivided) - Not Elevated - 1 Lane
- Road (Paved Undivided) - Not Elevated - 2 Lanes
- Road (Paved Undivided) - Not Elevated - 4 Lanes



Scale: 1:25,000

This map is a user generated static output from an Internet mapping site and is for general 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.

APPENDIX VII

**BACTERIAL STATISTICS FOR THE WHITEVALE WELL,
PROVIDED BY THE GREATER VERNON SERVICES - WATER**

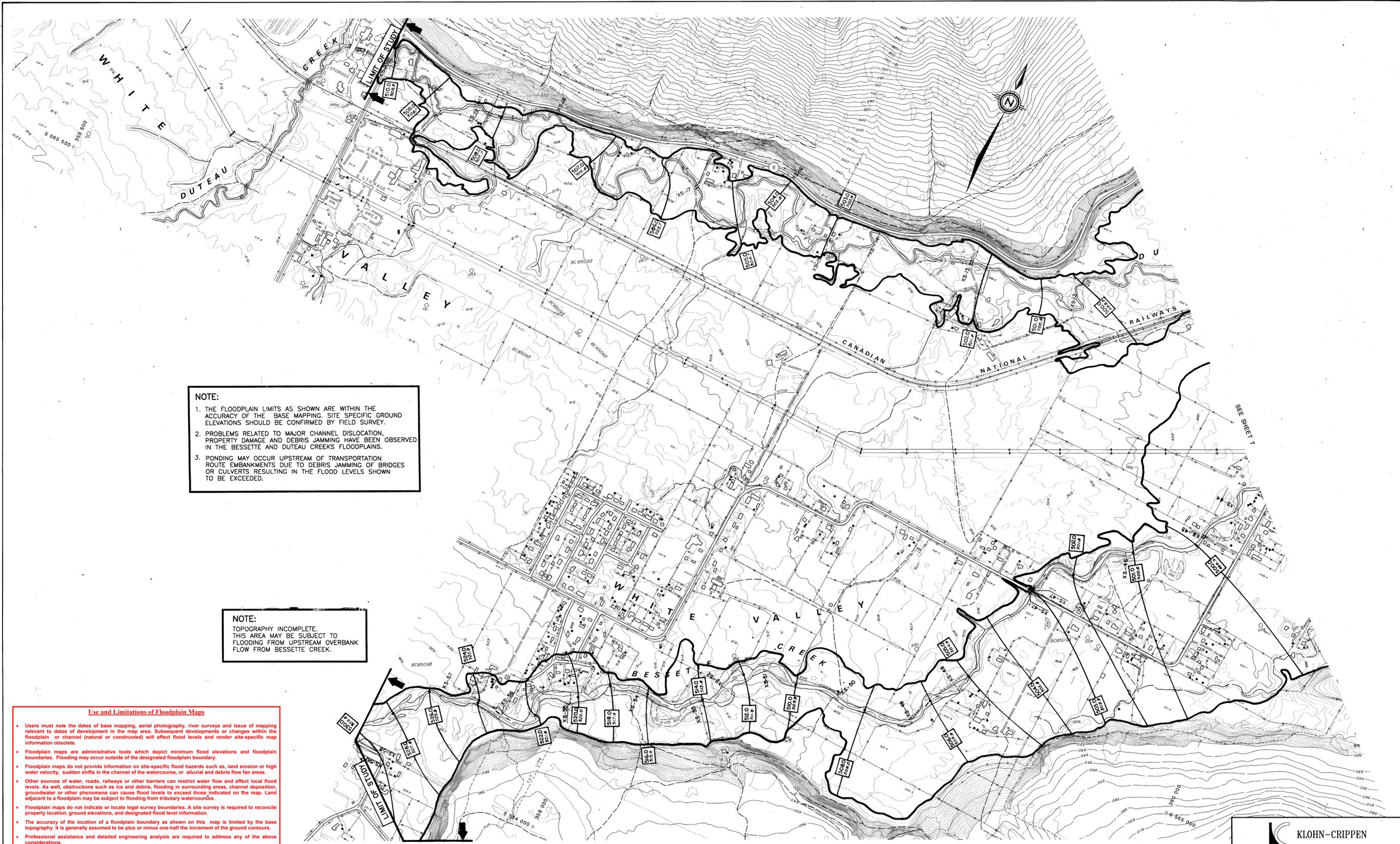
Water Sampling Results of Whitevale Water Distribution Facilities

Distribution Sample Sites	Bacterial Statistics		
	# Bacterial samples sent to Caro Environmental Lab	# Bacterial samples analyzed at GVS-W Lab	Results
Whitevale Reservoir	24	20	0 samples positive for coliform bacteria
775 Eastwood Road	11	11	0 samples positive for coliform bacteria
Whitevale Elementary School	10	7	0 samples positive for coliform bacteria
Total	45	38	0 samples positive for coliform bacteria

Whitevale Source Sample Sites	Bacterial Statistics		
	# Bacterial samples sent to Caro Environmental Lab	# Bacterial samples analyzed at GVS-W Lab	Results
Well 1 (Old Well)	5	12	0 samples positive for coliform bacteria
Well 2 (New Well)	20	13	1 sample positive for total coliform bacteria
Total	25	25	0 samples positive for coliform bacteria

APPENDIX VIII

**FLOODPLAIN MAPPING FOR BESSETTE & DUTEAU CREEK
NEAR WHITEVALE**



NOTE:

1. THE FLOODPLAIN LIMITS AS SHOWN ARE WITHIN THE ACCURACY OF THE BASE MAPPING. SITE SPECIFIC GROUND ELEVATIONS SHOULD BE CONFIRMED BY FIELD SURVEY.
2. PROBLEMS RELATED TO MAJOR CHANNEL DISLOCATION, PROPERTY DAMAGE AND DEBRIS JAMMING HAVE BEEN OBSERVED IN THE BESSETTE AND DUTEAU CREEKS FLOODPLAINS.
3. PONDING MAY OCCUR UPSTREAM OF TRANSPORTATION ROUTE EMBANKMENTS DUE TO DEBRIS JAMMING OF BRIDGES OR CULVERTS RESULTING IN THE FLOOD LEVELS SHOWN TO BE EXCEEDED.

NOTE:
TOPOGRAPHY INCOMPLETE. THIS AREA MAY BE SUBJECT TO FLOODING FROM UPSTREAM OVBANK FLOW FROM BESSETTE CREEK.

Use and Limitations of Floodplain Maps

- Users must note the dates of base mapping, aerial photography, river surveys and issue of mapping relevant to dates of development in the map area. Subsequent developments or changes within the floodplain or channel (natural or constructed) will affect flood levels and render site-specific map information obsolete.
- Floodplain maps are administrative tools which depict minimum flood elevations and floodplain boundaries. Flooding may occur outside of the designated floodplain boundary.
- Floodplain maps do not provide information on site-specific flood hazards such as, land erosion or high water velocity, sudden shifts in the channel of the watercourse, or alluvial and debris flow fan areas.
- Other sources of water, roads, railways or other barriers can restrict water flow and affect local flood levels. As well, obstructions such as ice and debris, flooding in surrounding areas, channel deposition, groundwater or other phenomena can cause flood levels to exceed those indicated on the map. Land adjacent to a floodplain may be subject to flooding from tributary watercourses.
- Floodplain maps do not indicate or locate legal survey boundaries. A site survey is required to reconcile property location, ground elevations, and designated flood level information.
- The accuracy of the location of a floodplain boundary as shown on this map is limited by the base topography. It is generally assumed to be plus or minus one-half the increment of the ground contours.
- Professional assistance and detailed engineering analysis are required to address any of the above considerations.

KLOHN-CRIPPEN

NOTES		FLOODPLAIN DATA		LEGEND		KEY MAP		REVISIONS		ISSUE OF MAPPING		ENVIRONMENT CANADA / INLAND WATERS		BRITISH COLUMBIA MINISTRY OF ENVIRONMENT		CANADA BRITISH COLUMBIA FLOODPLAIN MAPPING AGREEMENT		FILE NO.					
<p>Produced by: British Columbia Water Management Division, Hydrology Branch, Flood Identification Section.</p> <p>Survey: River survey done by Water Management Division, Hydrology Branch, Technical Support Section.</p> <p>Project: a) Horizontal control based on provincial network. b) Elevations are in metres and are referred to Sea Level Survey of Canada datum. (⊙ indicates Survey Monument).</p> <p>Mapping: Base mapping done by Lands Services Division, Surveys and Resource Mapping Branch, (SRMB) Topo/RS Section, Project 85-034 dated Aug. 1986. NAD 27. Air photography 1985.</p> <p>a) Contour interval 1 metre and greater; with spot elevations shown to 0.1 metres, with a specified accuracy of 1:0.2 metres, except where noted. Contact SRMB for further details on base mapping specifications.</p> <p>b) Grid origin referred to U.T.M. Projection Zone 11.</p>		<ol style="list-style-type: none"> 1. The Floodplain areas as depicted on this map have been designated pursuant to the Canada/British Columbia Floodplain Mapping Agreement (1988) by the Minister of the Environment for Canada and the Minister of Environment, Lands and Parks for British Columbia. Flooding may still occur outside of the designated Floodplain areas. The Ministers do not assume any liability by reason of the designation or failure to designate areas on this map. 2. The Designated Flood has a statistical frequency of occurrence of once every 200 years. 3. The flood levels were computed using a standard step method modelling technique, assuming open water flow conditions. 4. The floodplain limits assume the absence of all dykes. 5. The floodplain limits and flood levels include an allowance for freeboard. 6. The floodplain limits are not established on the ground by legal survey. 7. The floodplain limits are not delineated for side streams and tributaries. 8. The required setback of buildings from the natural boundaries of lakes and watercourses to allow for the passage of floodwaters and possible bank erosion is not shown. This information is available either through local municipalities or the Ministry of Environment, Lands and Parks. 9. MAPS AVAILABLE FROM THE MINISTRY OF ENVIRONMENT, LANDS AND PARKS, SURVEYS AND RESOURCE MAPPING BRANCH, MAPS B.C. MAP AND AIR PHOTO SALES, VICTORIA, B.C. 		<p>DESIGNATED FLOODPLAIN LIMIT</p> <p>FLOOD LEVEL</p> <p>200 Year Frequency</p> <p>20 Year Frequency</p> <p>(METRES G.S.C. DATUM)</p>		<p>SCALE 1:250 000</p>		<table border="1"> <thead> <tr> <th>No.</th> <th>DESCRIPTION</th> <th>DATE</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> <td> </td> </tr> </tbody> </table>		No.	DESCRIPTION	DATE				<p>DATE: September 30, 1998</p> <p>DRAWN: T.E. / A.D.</p> <p>CHECKED: RIVER SURVEY M.P.</p> <p>DESIGNED: B.B.</p> <p>ENGINEER: <i>R.T. Palmer</i></p>		<p>ENVIRONMENT CANADA / INLAND WATERS</p> <p>ENVIRONNEMENT CANADA / EAUX INTÉRIEURES</p> <p>BRITISH COLUMBIA MINISTRY OF ENVIRONMENT</p> <p>COLOMBIE-BRITANNIQUE / MINISTÈRE DE L'ENVIRONNEMENT</p>		<p>FLOODPLAIN MAPPING SHUSWAP RIVER, BESSETTE & DUTEAU CREEKS (MABEL LAKE TO LUMBY AREA)</p> <p>Scale in metres: 0 100 200 300 400 500m</p> <p>Scale in miles: 0 0.1 0.2 0.3 0.4 0.5</p> <p>RECOMMENDED: <i>R.W. Nicks</i></p> <p>APPROVED: <i>[Signature]</i></p>		<p>FILE NO. 35100-30/128-8355</p> <p>N.T.S. MAP NO. 82L</p> <p>SCALE 1:5 000</p> <p>NEGATIVE No.</p> <p>DRAWING No. 96-7-8</p> <p>REV. SHEET 8 of 8</p>	
No.	DESCRIPTION	DATE																					