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REPORT ON

**PRELIMINARY STEPS IN THE DEVELOPMENT OF A
GROUNDWATER PROTECTION PLAN
ANTWERP AND COLDSTREAM RANCH WELLS**

Submitted to:

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March 23, 2006



05-1440-101



EXECUTIVE SUMMARY

Golder Associates Ltd. (Golder) is pleased to present this report, which outlines the initial stages of developing a Groundwater Protection Plan (GWPP) for the municipal production wells in the Coldstream-Lavington area. This work was completed at the request of the Regional District of North Okanagan (RDNO) for Greater Vernon Services (GVS) and was developed in response to a renewal condition stipulated in the Operating Permit for the municipal water system (dated Feb. 2004) by the Interior Health Authority (IHA).

Greater Vernon Services (GVS) is a partnership established between the City of Vernon, the District of Coldstream and electoral Areas “B” and “C” of the RDNO (collectively referred to as “Greater Vernon”). The Greater Vernon community water system obtains their potable water from a number of surface water sources (Kalamalka Lake, Duteau Creek, McMechan Reservoir, Goose Lake Reservoir, and Deer Creek) and from four municipal production wells located in the Coldstream-Lavington area (GVS, 2004b). The four municipal production wells are the focus of this report.

Two of the municipal production wells are located in Lavington and are called Antwerp Springs Well 1 and Antwerp Springs Well 2. The other two are located on Coldstream Ranch and are referred to as Coldstream Ranch Well 1 and Coldstream Ranch Well 2. The Antwerp Springs Wells and the Coldstream Ranch Wells are about 7 km apart and are all located in close proximity to Highway 6. All four of the municipal production wells are located within the floodplain of Coldstream Creek and all water extracted is chlorinated at the pumphouse of each well.

This first stage of this GWPP was generally limited to the characterization of the local aquifers and the determination of the approximate time of travel zones for four municipal production wells. The assessment was based on a review of information from available reports and climatic data, together with a windshield survey of the Study Area. The initial stages of the GWPP were generally carried out based on the process outlined in the well protection toolkit (WPT), a guidance document developed by B.C. Ministry of Environment (MOE).

The subsurface geology in the Coldstream Valley is complex, with more than one aquifer system. A minimum of two aquifers exist north of Coldstream Creek at the Antwerp Springs Well service lot and there are potentially four additional aquifers within the Coldstream Ranch area.

The preliminary 60-day time of travel zones were estimated for the municipal production wells using the Calculated Fixed Radius (CFR) method outlined in WPT. A preliminary assessment to identify wells that may potentially be under the direct influence of surface water (GUDI) was also completed.

Based on the results of this initial phase of development of a GWPP for the GVS community production wells, the following conclusions are made:

- Antwerp Springs Well 1 is constructed in a localized, shallow, semi-confined to confined aquifer that is associated with the lower slopes of Silver Star Mountain. The preliminary GUDI assessment has identified Antwerp Springs Well 1 as likely being GUDI (or directly influenced by surface water).
- Coldstream Ranch Well 2 is constructed in a localized shallow unconfined aquifer that is associated with the King Edward Creek alluvial fan. The preliminary GUDI assessment has also identified Coldstream Ranch Well 2 as likely being GUDI.
- Antwerp Springs Well 2 and Coldstream Ranch Well 1 are constructed in deep, confined aquifers that could possibly be the same aquifer. These wells were identified as not likely GUDI in the preliminary GUDI assessment.
- The Antwerp Springs service lot contains Antwerp Springs Well 1 and Well 2 and an associated pumphouse. The service lot also contains the Large Diameter Well that was in service prior to Antwerp Springs Well 1 being constructed. The Large Diameter Well, which is currently not used is artesian and flows continually when Antwerp Springs Well 1 is not pumped. The flow from Large Diameter Well reportedly stops when Antwerp Springs Well 1 is pumped at a rate of approximately 500 USgpm or greater.
- A preliminary water balance analysis estimates the annual recharge to all aquifers to be approximately 2.9×10^6 m³/yr at the Antwerp Springs Wells and approximately 7.0×10^6 m³/yr at the Coldstream Ranch Wells.
- The total annual groundwater extraction for the GVS production wells for 2004 based on metering data is 1.2×10^6 m³/yr (4.4×10^5 m³/yr for the Antwerp Springs Wells and 7.7×10^5 m³/yr for the Coldstream Ranch Wells).
- Based on the calculated recharge and extraction estimates, the resultant net surpluses are 2.5×10^5 m³/yr for the Antwerp Springs area and 6.2×10^5 m³/yr at the Coldstream Ranch.

- The percentage of aquifer utilization (based on 2004 water usage data) is estimated to be 15 % for the Antwerp Springs Wells, 11 % for the Coldstream Ranch Wells and a total of 17% for all four GVS production wells. This estimate does not take into account water returned to the aquifer due to reported distribution losses or water utilized by other wells, particularly for irrigation purposes.
- The preliminary 60-day time of travel zone for the four municipal production wells was estimated using the CFR method. As Antwerp Springs Well 2 and Coldstream Ranch Well 1 are screened within deep, confined aquifers, the land use within the 60-day time of travel zone for these wells, and neighbouring wells constructed in the same aquifer, will not likely effect the water quality provided the wells are properly constructed and sealed. In contrast, the land use within the 60-day time of travel zone for the Antwerp Springs Well 1 and Coldstream Ranch Well 2 could potentially have a large impact on the water quality of these aquifers due to the absence of a protective confining layer.
- Potential water quality threats to Antwerp Springs Well 1 identified within the 60-day time of travel zone are residential septic systems, agricultural land use (crop land), the threat of an accidental chemical spill along Highway 6 and Coldstream Creek. There is also a drainage system on the Antwerp Springs service lot that presents a risk to the shallow aquifer via the Large Diameter Well.
- Potential water quality threats to Coldstream Ranch Well 2 identified within the 60-day time of travel zone are residential septic systems, agricultural land use (calving ground, cattle pastures and a silage storage area), and close neighbouring wells of unknown condition.

The results of the hydrogeological assessment indicate that of the four GVS production wells, the groundwater quality at Antwerp Springs Well 1 and Coldstream Ranch Well 2 are considered to be at the greatest risk of degradation. Coldstream Ranch Well 2 is completed in shallow sediments without an overlying confining layer to protect the aquifer from surface activities such as residential septic systems and agriculture. Although Antwerp Springs Well 1 is semi-confined to confined by a “clayey silt with minor sand” layer, the lateral extents of the confining layer or the protective value of this layer is uncertain. In addition, both wells have been identified as being potentially GUDI due to their shallow nature, the proximity of Antwerp Springs Well 1 to a surface water body and the historical presence of Total Coliform. In contrast, Antwerp Springs Well 2 and Coldstream Ranch Well 1 are considered relatively protected from groundwater degradation due to the presence of a thick clay layer above the aquifer(s).

We understand that the Master Water Plan for the RDNO (NOWA, 2002) recommends that the Coldstream Ranch Wells 1 and 2 be used solely for irrigation purposes in the future. Based on the results of this Study, it is recommended that consideration be given to using only the wells within the deep confined aquifer(s) (Antwerp Springs Well 2 and Coldstream Ranch Well 1) for potable water and using the Shallow Wells (Antwerp Springs Well 1 and Coldstream Ranch Well 2) solely for irrigation purposes. Presumably, treatment may be required to address the reported manganese concerns associated with the deeper wells.

Should this approach be considered, future work should include further characterization of the deep aquifer(s). A characterization study would examine regional information to refine the lateral extents of the aquifer(s), including, geo-chemical analysis to assess the possible link between Antwerp Springs Well 2 and Coldstream Ranch Well 1, should sufficient groundwater chemistry information be available. Information from the characterization study would be used to develop a numerical groundwater flow model. The numerical model would be used to refine the capture zones of Antwerp Springs Well 2 and Coldstream Ranch Well 1.

The information provided from a numerical model would assist GVS – Water in completing further steps in the GWPP in developing management strategies for the aquifer(s). For example, the information could be used to:

- Refine capture zones and time of travel zones where strategies are required to protect the water quality and quantity. An example of protecting water quality would be to ensure all wells developed in the aquifer within the capture zone are properly sealed and cased if still functioning and properly decommissioned if they are no longer in use. An example of protecting water quantity is to restrict any high capacity well development within the capture zones.
- Assist in identifying the most appropriate locations for future wells sites within the deep aquifer(s).

Once a numerical model was completed, the following steps in the WPT could continue:

- Conduct a contaminant inventory (Step 3) to identify potential threats that could impact the municipal production wells. The effort should concentrate on identifying contaminant sources (i.e. septic sources, unknown wells, historical high risk land uses and current potential risks) and potential risks;
- Designate groundwater protection area(s) and develop management strategies (i.e. education and/or land use planning) to protect groundwater within those areas (Step 4);

- Develop a Contingency Plan (Step 5), that would identify short-term and long-term alternative water supply sources in the event of a disruption to the water supply source and an Emergency Response Plan to address potential contamination events; and
- Develop and Evaluate a Groundwater Monitoring Plan (Step 6): this step would consist of an assessment of historical monitoring results, a review of the scope of the current monitoring plan, and making refinements to the monitoring program based on the results of Steps 2 and 3.

If the shallow wells are kept on-line with the municipal distribution system and remain a potable water source, further work required would include:

- Conducting additional analysis to confirm whether the wells are GUDI and identify actions to be carried out in the event that GUDI status is confirmed,
- Refine the capture zones of the shallow wells.
- Conduct a contaminant inventory within the capture zones and continue with the other steps in the GWPP,
- Refurbish the drainage system on the Antwerp Springs lot by routing ditch drainage and general surface drainage away from wells and installing a backflow prevention valve on the Large Diameter Well, and
- Decommissioning the large diameter well.

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1.0 INTRODUCTION

Golder Associates Ltd. (Golder) is pleased to present this report, which outlines the initial stages of developing a Groundwater Protection Plan (GWPP) for the municipal production wells in the Coldstream-Lavington area. This work was completed at the request of the Regional District of North Okanagan (RDNO) for Greater Vernon Services (GVS) and was developed in response to a renewal condition stipulated in the Operating Permit for the municipal water system (dated Feb. 2004) by the Interior Health Authority (IHA).

It is understood that this report may be utilized as a supporting document for further funding applications to the BC Ministry of Community Services (MCS) from their Infrastructure Planning Grant Program. The purpose of the grant would be to aid in funding further steps of the GWPP.

Greater Vernon Services (GVS) is a partnership established between the City of Vernon, the District of Coldstream and electoral Areas “B” and “C” of the RDNO (collectively referred to as “Greater Vernon”). With the regionalization of three former water utilities, GVS – Water is responsible for regional water planning, quality, quantity and delivery of water to residents in these areas. The RDNO is the “Owner of the Utility”, GVS is the “Administrative” body, while the City of Vernon and the District of Coldstream have been “Contracted to Operate” the water distribution system.

GVS obtains their potable water from a number of surface water sources (Kalamalka Lake, Duteau Creek, McMechan Reservoir, Goose Lake Reservoir, and Deer Creek) and from four municipal production wells located in the Coldstream-Lavington area (GVS, 2004b). The four municipal production wells are the focus of this report.

Two of the municipal production wells are located in Lavington and are called Antwerp Springs Well 1 and Antwerp Springs Well 2. The other two are located on Coldstream Ranch and are referred to as Coldstream Ranch Well 1 and Coldstream Ranch Well 2. The Antwerp Springs Wells and the Coldstream Ranch Wells are about 7 km apart and are all located in close proximity to Highway 6. All four of the municipal production wells are located within the floodplain of Coldstream Creek and all water extracted is chlorinated at the pumphouse of each well.

Currently, all four GVS production wells supply potable water to residential and agricultural properties in eastern Coldstream and Lavington, with a few industrial customers in the Lavington area (GVS, 2004a). The Master Water Plan for Greater Vernon recommends diversion of the Coldstream Ranch Wells from the distribution system for irrigation use only. The Antwerp Springs Wells will remain a potable water source and therefore, the GWPP is to primarily focus on the Antwerp Springs Wells.

This work was authorized by Mr. Al Cotsworth of RDNO on May 20, 2005 and follows the methodology contained in a proposal submitted by Golder on May 19, 2005.

2.0 METHODOLOGY

The Well Protection Toolkit (WPT) was used as a guide for the Coldstream GWPP. The WPT was developed jointly by the BC Ministry of Environment, Lands and Parks (now the Ministry of Environment (MOE)), the Ministry of Health and Ministry Responsible for Seniors in 2000. It 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.

Based on our experience, the process of completing the six steps of the WPT requires customization to meet the unique needs of each community to ensure the investment delivers the maximum protection of their water supply. For this study, the basic components of the first two steps (Steps 1 and 2) of the WPT were followed, with emphasis on aquifer characterization together with wellhead characterization. It is understood that further progress in the development of RDNO's GWPP (the completion of Steps 3, 4, 5 and 6) will be a function of funding availability.

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

- Assist with the establishment of an aquifer protection technical committee with representation from the purveyor, government and technical experts;
- Assist the technical committee with the establishment of goals, determining information needs and the development of an action plan;
- Gather and review available information on the community wells and aquifer(s), prepare maps of the extent and sections through the aquifer to identify physical properties including aquifer thickness and flow direction;
- Identify data gaps and complete a field reconnaissance to collect additional information;

- Identify aquifer recharge and discharge areas, as well as an overall aquifer water balance based on the established physical properties;
- Estimate the extent of capture zones for the production water wells using the most appropriate analytical method outlined in the WPT (Calculated Fixed Radius or Analytical Equations method); and
- Report Preparation.

Although not specified in the project proposal, a preliminary assessment to determine if the municipal production wells are under the direct influence of surface water (GUDI) was also conducted.

Water quality was only touched upon within this report as issues related to existing water quality and monitoring were beyond the work scope for this initial stage of GWPP.

3.0 STUDY AREA

3.1 Location and Climate

The Study Area is within the District of Coldstream municipal boundaries and includes portions of Coldstream Ranch and Lavington. Coldstream is located in the northern interior of British Columbia, along Highway 6, approximately 7 km east of Vernon. Figure 1 shows the location and approximate area of the Study Area considered for this GWPP. The footprint of the Study Area covers an area approximately 10 km² in size.

The Study Area is located mainly within the floodplain of Coldstream Creek. Coldstream Creek flows south from its headwaters in the mountains towards the floodplain, and then flow west along the broad valley to Kalamalka Lake. Land use in the Study Area is mainly dominated by agriculture and residential housing, with some commercial and industrial use. The industries present in the study area include a sawmill, a wood manufacturing operation and a glass manufacturing plant, all within Lavington.

The climate of Coldstream consists of warm summers and cool, moist winters. The “Vernon Coldstream Ranch” weather station is located on the Coldstream Ranch within the Study Area at an elevation of 482 meters above sea level (masl). Data from this weather station indicates the annual average daily temperature of Coldstream is 7.4° C, with daily average temperatures ranging from -5.0° C in January to 19.1° C in July, as reported in “Canadian Climate Normals, 1971 – 2000” (Environment Canada). The total annual precipitation reported for Coldstream is 484.4 mm per year.

3.2 Topography

The topography in the Study Area is characterized by the flat floodplain area of Coldstream Creek surrounded by steep slopes to the north and south. As shown in Figure 2, Coldstream Valley is bounded by Silver Star Mountain to the north and by the Thompson Plateau to the south. The headwaters of Coldstream Creek drain the slopes of Silver Star Mountain (peak elevation of approximately 1890 masl), while the main tributaries of Coldstream Creek (Deer/King Edward Creek and Brewer Creek) drain from Long Mountain (peak elevation of approximately 1641 masl)¹ on the Thompson Plateau.

The catchment area of Coldstream Creek generates runoff from rainfall and snowmelt that contributes recharge water to the local aquifers. Figure 2 also shows the catchment area of Coldstream Creek, which is approximately 149 km².

3.3 Surficial Geology

The surficial geology in the Coldstream Valley is complex due to the stagnation of the Okanagan ice lobe in that area and successive stages of glacial Lake Penticton (Nasmith, 1962). Outwash terraces were initially deposited along the ridges of the Coldstream Valley from meltwater streams draining into Lake Penticton. The outwash terraces were later eroded as the elevation of Lake Penticton dropped and sand and gravel layered with glacial-lake sediments were deposited. According to Nasmith, the surficial deposits within the Study Area consist of the following three categories, which are listed from youngest to oldest:

1. *Alluvial fans and deltas, and associated gully and stream channel deposits:* Are classified as recent and are erosional and depositional features of the present day streams. The deposits vary from fine silty sand to coarse bouldery gravel. These deposits occur where Coldstream Creek and King Edward Creek drain from the steep slopes onto the valley bottom. The Coldstream Creek alluvial fan is east of the Antwerp Springs Wells location.
2. *Raised alluvial fans, terraces, and deltas:* These glacial features are classified as late glacial and are similar to glacial outwash deposits which consists of stratified drift ranging in texture from fine sand to coarse bouldery gravel, including till. They were formed by streams that were at a higher level than present that were downcut or partially eroded. These deposits occur along the valley bottom from the Coldstream Creek alluvial fan to the intersection of Kalamalka Lake Road and Highway 6 at Coldstream Ranch.

¹ NTS Map of Vernon 82 L/SW, 3rd status edition.

3. *Mixed unconsolidated deposits:* These deposits consist of glacial outwash (stratified drift ranging in texture from fine sand to coarse bouldery gravel) and earlier deposits. They could be mantled with till or thin glacial and post-glacial deposits, however they are so thin that they do not obscure earlier deposits. These features are found on the northern ridges boarding the Coldstream Valley bottom.

3.4 Bedrock Geology

Apart from providing a physical boundary within which the unconsolidated sediments of the valley are situated, the bedrock in the Study Area is expected to provide minimal recharge to the local groundwater flow regime. According to the BC Geological Survey website², Lavington is underlain by sedimentary rock within the Nicola and Harper Ranch Groups, consisting of mudstone, siltstone, shale and fine clastic sedimentary rocks. The Coldstream Ranch is primarily underlain by metamorphic rocks in the Silver Creek Formation, consisting of gneiss, schist and semishist.

3.5 Municipal Groundwater Use

As discussed previously, GVS has a total of four production wells used to supplement water supply to the Greater Vernon Area. There are also two other wells located on the Antwerp Springs lot (Large Diameter Well and a 150 mm diameter exploratory well) that are no longer in use. Figure 3 indicates the location of the municipal production wells and known neighbouring wells as identified from the water well database (WELL) maintained by the MOE. Table 1 provides a summary of the GVS production wells currently in use and the following provides a brief description of all the wells:

- *Antwerp Springs Well 1* – is located in Lavington, approximately 13 km east of Vernon. It is located on a small service lot with access from Highway 6, close to the junction of Highway 6 and School Road, approximately 30 m north of Coldstream Creek. The driller's log for the well indicates sand and gravel, possibly fill, exists from the ground surface to 2.7 metres below ground surface (mbgs), underlain by silt with organic material to 3.4 mbgs, clayey silt from 3.4 mbgs to 7.0 mbgs and gravel and sand from 7.0 mbgs to 13.1 mbgs. The drilling program was terminated at 13.3 mbgs in a clay layer that started at 13.1 mbgs. The well is screened from 8.5 mbgs to 13.3 mbgs. The static water level measured at the time of drilling on October 22, 1998 was 1.2 mbgs. Antwerp Springs Well 1 is utilized on a year round basis. The nitrate levels and periodic presence of total coliform in this well are of concern.

² <http://www.em.gov.bc.ca/Mining/Geosurv/MapPlace/themeMaps.htm>

- *Antwerp Springs Well 2* – is located approximately 10 m south of the Antwerp Springs Well 1 and 20 m north of Coldstream Creek. The driller's log for this well indicates clay exists from the ground surface to 11.6 mbgs, underlain by sand and gravel to 14.0 mbgs, brown clay from 14.0 mbgs to 21.3 mbgs, cemented gravel from 21.3 mbgs to 34.1 mbgs, grey clay from 34.1 mbgs to 54.9 mbgs and sand from 54.9 mbgs to 62.8 mbgs. The well is screened from 57.0 mbgs to 62.2 mbgs and the static water level measured at the time of installation on January 29, 1999 was 3.9 mbgs. Antwerp Springs Well 2 is used through the irrigation season (April - October) with alternating pump starts with Antwerp Well 1. The pump is always in lag to supplement Antwerp 1 in case of failure or high water demand (i.e. fire). The water supplied from Antwerp Springs Well 2 is considered hard and has a high manganese content, which has caused precipitation problems in the distribution system.
- *Coldstream Ranch Well 1* – is located on the Coldstream Ranch approximately 4 km east of Vernon and 7 km west of the Antwerp Springs Wells. It is situated on the southeast corner of the intersection of Kalamalka Lake Road and Highway 6, approximately 200 m north of Coldstream Creek. The driller's log for this well indicates black sandy soil exists from the ground surface to 0.6 mbgs, underlain by brown clay from 0.6 mbgs to 7.0 mbgs, grey sand from 7.0 mbgs to 19.5 mbgs, grey clay from 19.5 mbgs to 44.5 mbgs, sand and gravel from 44.5 mbgs to 50.0 mbgs and cemented sand and gravel (most likely till) from 50.0 mbgs to 53.4 mbgs where the well was terminated. The well is screened from 44.0 mbgs to 49.4 mbgs in a confined sand and gravel layer. The static water level was at ground level (i.e. 0 mbgs) at the time the well was drilled. The water is considered hard with high manganese content similar to the Antwerp Springs Well 2. It is utilized on a seasonal basis, generally during the irrigation season (April - October) and freshet. It is also linked to the Supervisory Control and Data Acquisition (SCADA) program used to remotely control many of the GVS network facilities. SCADA is programmed to start pumping from Coldstream Ranch Well 1 when the weir reading at the Duteau Creek intake is low. The Master Water Plan recommends that this well be used for irrigation purposes only in the future, when demand is high during the irrigation season. (NOWA, 2002).
- *Coldstream Ranch Well 2* – is also located on the Coldstream Ranch approximately 475 m to the southeast of Coldstream Ranch Well 1 and 235 m to the south of Coldstream Creek. Coldstream Ranch Well 2 is surrounded by some residential housing, calving paddock, cattle pastures and a silage storage area all belonging to the Coldstream Ranch. The driller's log for this well indicates brown sand and gravel exists from the ground surface to 19.8 mbgs, brown clay from 19.8 mbgs to 21.0 mbgs, brown sand from 21.0 mbgs to 24.7 mbgs and brown sand with brown clay from 24.7 mbgs to 25.0 mbgs where the well was terminated. The well is screened from 9.8 mbgs to 23.9 mbgs and is considered unconfined as the well is screened

within the upper sand and gravel deposit. The static water level was reported to be 6.3 mbgs on February 7, 2000; some rehabilitation work was completed on the well. Coldstream Ranch Well 2 has had problems with elevated nitrate levels and with the occasional occurrence of Total Coliform. The Master Water Plan recommends that this well also be used for only irrigation purposes in the future (NOWA, 2002).

The following well descriptions are for the two wells no longer in use on the Antwerp Springs service lot:

- *Large Diameter Well* – was the main supply well on the Antwerp Springs service lot prior to the construction of Antwerp Springs Well 1. The large diameter well was originally constructed to take advantage of a natural spring that surfaced on-site, flowing overland to Coldstream Creek (Kala, 1998). The well construction details indicate the well consists of an upper storage reservoir with a diameter of 2.5 m and a depth of 3.4 m, with a series of 75 mm well points driven to a depth of 6.1 to 7.6 mbgs. Water enters the storage reservoir via artesian pressure and is subsequently pumped from the reservoir, with overflow directed to Coldstream Creek via a drainage pipe. This well is no longer in use and no records were found pertaining to the fate of this well after the construction of Antwerp Springs Well 1. However, during the site reconnaissance visit, the location of the large diameter well was easily determined. It is suspected that a concrete lid was installed on the well with a layer of soil on top to support grass growth. The well continues to flow and discharge is directed to Coldstream Creek via an open overflow pipe. The flow reportedly decreases when Antwerp Springs Well 1 is actively pumped and generally stops flowing completely when the Antwerp Springs Well 1 is being pumped at a flow rate of approximately 500 USgpm (Mr. Blaeser, pers. comm., 2005).
- *150 mm Diameter Exploratory Well* – Prior to the construction of Antwerp Springs Well 1, a 150 mm Diameter Exploratory Well was drilled at the Antwerp Springs Well site. This well was utilized to characterize the aquifer prior to the installation of the proposed production well (or Antwerp Springs Well 1). During the pumping test of Antwerp Springs Well 1, the Exploratory Well was used as an observation well (Kala, 1998). No documentation regarding the final fate of this well was found, however, the site reconnaissance visit indicated that the well was likely decommissioned and probably buried beneath the current pumphouse.

Figure 4 provides a schematic of the Antwerp Springs service lot and the lot drainage system. The drainage system consists of two manholes and connecting pipes draining directly into Coldstream Creek. The northern manhole contains an inflow drainage pipe connected to the culvert beneath the site driveway, which appears to drain the Highway ditch. It is possible that the pipe may lead to a french drain that collects surface drainage from upslope areas. The outflow of the northern manhole flows into the southern manhole, which is also connected to two other inflow pipes. One inflow pipe is the overflow pipe from the Large Diameter Well and the other inflow pipe is the surge overflow pipe from the pumphouse of Antwerp Springs Well 1 and Well 2. There is no check valve on the overflow pipe from the Large Diameter Well, but the overflow pipe from the pumphouse is protected by an air gap in the pumphouse which would inhibit surface flow entering Antwerp Springs Well 1 and Well 2. The outflow pipe of the southern manhole flows directly into Coldstream Creek via an open pipe. Although the outflow pipe is generally above the water level of Coldstream Creek, it is periodically under water during high flow events (Mr. Blaeser, pers. comm., 2005).

The pumping rates of the four municipal production wells in use are controlled by the water level within the Lavington Reservoir. Currently, the transducer within the Lavington Reservoir is set so that the wells will start pumping when the volume drops to 85% and stops when the volume is at 95%.

3.6 Other Groundwater Users

A comprehensive inventory of private water wells was beyond the scope of this study. However, Golder assembled the following information concerning local groundwater use.

The Study Area contained 41 well logs as identified in WELL maintained by MOE. In addition, GVS provided well logs for Antwerp Springs Well 1 and Antwerp Springs Well 2, which did not exist in the WELLS database. Figure 3 provides the locations of the wells identified, while Table 1 provides a summary of the well logs available. Copies of all the well log records within the Study Area are provided in Appendix I.

Most of the wells identified within the Study Area are within the service supply area of the GVS water distribution system. These wells are inferred to be inactive, however, very little is known about them and they may still be used for irrigation or other purposes. The Coldstream Ranch operates a number of wells for irrigation purposes, although the locations of which wells are used and what quantities pumped are unknown. Mr. Blaeser, Operator for the District of Coldstream, reported that during irrigation season a reduction of the output capacity of Coldstream Ranch Well 2 occurs, presumably from interference from the irrigation wells in operation on the Coldstream Ranch.

The Coldstream Valley Rate Payers and the Abbot Field Water Users Community are small water purveyors within the Study Area. The Coldstream Valley Rate Payers are reported to use a private artesian well for irrigation (Ms. Clark, pers. comm., 2005). No other information on either of the purveyors was available regarding the well locations or particulars of their operations.

4.0 HYDROGEOLOGICAL ASSESSMENT

4.1 Overview

Only one aquifer (Aquifer 352) has been identified within the Study Area under the MOE's aquifer classification system, the aquifer extent of which is illustrated in Figure 5. Aquifer 352 consists of sand and gravel and is estimated to be approximately 15 km² in size. The aquifer is classified as "highly productive, low vulnerability to contamination and moderately developed" (MWLAP Classification IIC)³. The MOE classification system is subjective and is based on an office assessment of a number of factors such as well logs supplied by drillers, aquifer demand, productivity, size, soil type, water quality and vulnerability to surface contamination.

Using the available well logs, Cross-Section A-A' (Figure 6) was prepared representing a view of the subsurface geology in the area of the Antwerp Springs Wells and Cross-Section B-B' (Figure 7) was prepared representing a view of the subsurface geology in the area of the Coldstream Ranch Wells. The locations of the cross sections are provided in Figure 3.

Interpretation of the cross sections and examination of the other well logs in the area, suggests that the subsurface geology in the area is highly complex and more than one aquifer system exists within the Study Area. The following section provides a brief explanation of the aquifer systems within the Study Area.

4.1.1 Antwerp Springs

Cross-Section A-A' (Figure 6) provides an interpretation of the surficial geology in the vicinity of the Antwerp Springs Wells based on logs of the Antwerp Springs Wells and the closest neighbouring well (WTN 48118). Cross-Section A-A' indicates a minimum of two aquifers exist north of Coldstream Creek, identified as:

- Shallow aquifer (AS:shallow), is a relatively shallow, semi-confined to confined aquifer that is isolated to the north of Coldstream Creek. Antwerp Springs Well 1 is screened within AS:shallow.

³ http://wlapwww.gov.bc.ca/cgi-bin/env_exec/wwwapps/wabot/aquifers

- Deep aquifer (AS:deep), is a confined aquifer that extends south of Coldstream Creek. Antwerp Springs Well 2 is screened within AS:deep.

Examination of WTN 48118 indicates that AS:deep extends to the south of Coldstream Creek, although AS:shallow does not. It is likely that both aquifer systems were originally deposited in the stagnation period of the Okanagan ice lobe (see Section 3.3), formed by a combination of ice-contact and fluvial deposition forming terraces along the lower slopes of Silver Star Mountain. Erosion of these terraces occurred at a later stage and lacustrine materials were deposited. The result of this activity was the truncation of AS:shallow at some point between WTN 48118 and Antwerp Springs Well 2.

AS:shallow appears to extend north within the terrace deposits on the slopes of Silver Star Mountain. As AS:shallow terminates between Antwerp Springs Well 2 and WTN 48118, it is likely that AS:shallow provides flow to Coldstream Creek, especially as there is significant artesian pressure as indicated by the Large Diameter Well. AS:shallow may extend laterally along the lower slopes of Silver Star Mountain, although there is insufficient information to confirm this.

Based on a preliminary analysis of the available well logs within the Study Area, AS:deep may correlate with Aquifer 352 as defined by MOE. AS:deep appears to initiate approximately 1.2 km to the east (WTN 62341 and 51248) and follow the valley bottom to the west, possibly as far as the Coldstream Ranch wells, or further. AS:deep may be connected to either the aquifer identified as CR:AQ3 or CR:AQ4 as defined below (see Section 4.1.2), however, the presence of a significant till layer(s) identified in well logs between the Coldstream Ranch Wells and Antwerp Springs Wells makes an accurate determination difficult. Further field analysis including geochemical studies would be required to verify the connectivity of these aquifers.

4.1.2 Coldstream Ranch

Cross-section B-B' provides an interpretation of the surficial geology in the vicinity of the Coldstream Ranch Wells by using the well logs of the Coldstream Ranch Wells and some of the neighbouring wells (WTN 46619, 19026, 49978, 2499 and 49912). The cross-section indicates that there are potentially four aquifers within this area. The following describes the aquifers identified within cross-section B-B':

- Uppermost shallow aquifer (CR:AQ1) – is an unconfined aquifer comprised of sand and gravel. CR:AQ1 starts on the north shore of Coldstream Creek and extends south of the creek towards King Edward (Deer) Creek. CR:AQ1 appears to be related to the King Edward Creek alluvial fan and is likely hydraulically connected to Coldstream Creek.

- Shallow Aquifer (CR:AQ2) – is made up of a sand and gravel layer that is at ground level northwest of Kalamalka Lake Road (where CR:AQ1 terminates), but becomes confined beneath a clay layer where CR:AQ1 exists. The clay layer ranges from 1.2 m to 6.5 m in thickness, becoming thinner to the south, in the vicinity of Coldstream Ranch Well 2. These aquifers may converge further south; however, there is insufficient information available to make this assertion. Coldstream Ranch Well 2 is screened within both CR:AQ1 and CR:AQ2 with the screen spanning the clay layer separating the aquifers.
- Lower Aquifer (CR:AQ3) – is a confined aquifer composed of a sand and gravel layer situated below a 15 m to 25 m thick clay layer. CR:AQ3 may be hydraulically connected to the AS:deep as described in Section 4.1.1, however there is insufficient information to confirm this. Coldstream Ranch Well 1 is screened within this aquifer.
- High Pressure Artesian Aquifer (CR:AQ4) – is a confined aquifer separated from CR:AQ3 by a till layer approximately 13 m thick. CR:AQ4 is the lower most aquifer encountered to date and a well completed in this aquifer was capped by the province to control the large flow (Scott, 1968).

4.2 Aquifer Characteristics

This section summarizes the available aquifer characteristics provided or calculated from available pumping test data for each municipal well. No aquifer properties have been provided for aquifers not supplying the municipal production wells.

4.2.1 Antwerp Springs Well 1

AS:shallow is the source aquifer of Antwerp Springs Well 1. AS:shallow is considered semi-confined to confined and is approximately 5.5 m thick. Antwerp Springs Well 1 was constructed in August 1998 and a 24-hour pumping test was conducted on the well starting October 22, 1998 (Kala, 1998). The nearby large diameter well and exploratory well were both used as non-pumping observation wells. An aquifer transmissivity of 216 m²/day with a storage coefficient of 7.84 was reported by Kala. Using the pumping test data from the Kala report, a transmissivity of 1360 m²/day and storage coefficient of 1.7×10^{-5} were re-calculated for the Antwerp Springs Well 1 using AQTESOLV. Based on a literature review, specific storage values for a semi-confined to confined aquifers are expected to be in the range of 10^{-5} to 10^{-6} (Fetter, 2001).

4.2.2 Antwerp Springs Well 2

AS:deep is the source aquifer for Antwerp Springs Well 2. AS:deep is confined and is approximately 9 m thick. Antwerp Springs Well 2 was constructed in November 1998 and a 24-hour pumping test was conducted on the well starting January 29, 1999 (Kala, 1999). The neighbouring well (WTN 48118) was utilized as a non-pumping observation well. An aquifer transmissivity of 2837 m²/day with a storage coefficient of 1.1×10^{-3} was reported by Kala. Using the pumping test data from the Kala report, a transmissivity of 2400 m²/day were re-calculated for the Antwerp Springs Well 2 using AQTESOLV.

4.2.3 Coldstream Ranch Well 1

Coldstream Ranch Well 1 is screened within a deep, confined aquifer referred to in this report as CR:AQ3 (see Section 4.1.2). This aquifer is approximately 6 m thick at Coldstream Ranch Well 1. Coldstream Ranch Well 1 was constructed in March 1981 and a 28-hour pumping test was conducted on the well (PHCL, 1981). The high pressure artesian well (WTN 19026) was utilized as a non-pumping observation well by measuring the interference in artesian flow during the pumping test. The aquifer transmissivity calculated from the well recovery data was 236 m²/day, however PHCL reported that this estimate was likely meaningless because during the test, the lower artesian aquifer was supplying recharge by the uncased drill hole of the high pressure artesian well. Using AQTESOLV and the pumping test data from the PHCL report, a transmissivity of 265 m²/day was calculated for CR:AQ3, however, as stated in the PHCL report, it is unlikely that this value represents the true value of the aquifer transmissivity due to the recharge provided by the lower artesian aquifer.

4.2.4 Coldstream Ranch Well 2

Coldstream Ranch Well 2 is screened within two aquifers, identified within this report as CR:AQ1 and CR:AQ2. CR:AQ1 is an unconfined, shallow sand and gravel aquifer, while CR:AQ2 is confined by a thin clay layer (1.2 m to 6.5 m thick) in areas where CR:AQ1 exists. CR:AQ2 may converge with CR:AQ1 to the south, however, there is insufficient information to make this assessment. Because the uppermost aquifer is unconfined, Coldstream Ranch Well 2 is considered to be screened within an unconfined aquifer.

Coldstream Ranch Well 2 was originally drilled in 1982 and was later rehabilitated in 2000 as the production rate of the well had decreased (Kala, 2000). There was no available report pertaining to the original well installation and the rehabilitation report did not include an estimate of the aquifer transmissivity nor the pumping test data, so an estimate using AQTESOLV could not be completed. However, a preliminary estimate of transmissivity was calculated using an empirical relationship established by Driscoll (2003) for unconfined aquifers using the specific capacity provided in the Kala Rehabilitation Report (Kala, 2000). The transmissivity estimate was within the range of 2800 m²/day and 3200 m²/day. This

transmissivity estimate is not considered representative of either CR:AQ1 or CR:AQ2, since the well appears to be screened across the two different aquifers.

4.3 Groundwater Flow Direction and Hydraulic Gradient

Groundwater flow directions or hydraulic gradients could not be calculated from water-level data available for the municipal production wells or from the MOE WELL database because of the limited number of wells in the Study Area, the multiple aquifers present and the uncertainty regarding which aquifer(s) some of the wells are screened within.

Based on the local topography, the groundwater flow direction of the AS:shallow aquifer (Antwerp Springs Well 1) is inferred to be from north to south, while the groundwater flow direction of the CR:AQ1 (Coldsteam Ranch Well 2) is inferred to be from south to north. Both aquifers likely discharge to Coldstream Creek. Coldsteam Ranch Well 2 is also screened within CR:AQ2, although there is not enough information about the extent of this aquifer to infer the groundwater flow direction.

As Coldsteam Ranch Well 1 and Antwerp Springs Well 2 are both screened within deep confining aquifers (CR:AQ3 and AS:deep, respectively), the groundwater flow direction of these aquifers can not be inferred by the surrounding topography. If it were determined that Coldsteam Ranch Well 1 and Antwerp Springs Well 2 were constructed within the same aquifer (*i.e.* CR:AQ3 = AS:deep), then based on the approximate elevations and water levels of these wells, the general groundwater flow direction of this aquifer is from east to west with an approximate hydraulic gradient of 0.009 m/m.

4.4 Aquifer Water Balance

4.4.1 Recharge

The estimates of annual recharge to aquifers are usually calculated using two methods and comparing the results. One method considers climatic data for the area and estimates the amount of infiltration contributions to recharge. The other method used the Darcy Flux Method to estimate the flow across a section of an aquifer. Due to the presence of multiple aquifers and the lack of available hydrogeological data, recharge was estimated using climatic data only.

For the purpose of this report, an estimate of overall annual recharge was calculated for the general areas of the Antwerp Springs Wells and the Coldstream Ranch Wells. The amount of recharge to individual aquifers could not be determined due to lack of information concerning the extents of each aquifer and the hydraulic gradients.

In using climatic data, it was assumed that recharge to all the aquifers in the unconsolidated valley deposits was primarily via infiltration of total precipitation within the catchment area.

As shown in the following table, a wide range of recharge rates can occur based on climate and topography, 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. In the catchment area of Coldstream Creek and its tributaries, there is a combination of steep mountain slopes and valley bottom, hence 10% was used. It was also assumed that the majority of the infiltration (approximately 80%) is concentrated in the alluvium sediments within the base of the valley. It is anticipated that the remainder of the infiltration (20%) recharges localized bedrock aquifer systems.

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	10% (300.9 mm/yr)	Golder, 2003
Summerland, B.C.	5% (327 mm/yr)	Golder, 2005

The annual recharge calculation uses the mean annual precipitation reported for Coldstream Ranch of 484.4 mm/yr and assumes that approximately 10% of this precipitation, or 48.4 mm/yr, is available as recharge. Of this, 80% or 38.7 mm/yr is directed to the alluvium sediments in the valley. The recharge availability is then multiplied by the catchment area to obtain the annual recharge to all the aquifers in the study area:

Well Field Affected	Aquifers	Catchment Area ¹	Annual Recharge
Antwerp Springs Wells	AS:shallow and AS:deep	76 km ²	2.9×10 ⁶ m ³ /yr
Coldstream Ranch Wells	CR:AQ1, CR:AQ2, CR:AQ3, CR:AQ4,	181 km ²	7.0×10 ⁶ m ³ /yr

1. The Catchment Area of the Coldstream Ranch includes the Antwerp Springs Well Catchment Area.

The amount of annual recharge calculated for each area is the estimate of the total recharge to all aquifers in the unconsolidated valley bottom, including any that have not been identified.

Note that this estimate of recharge is based on precipitation only and does not account for other sources of recharge to the aquifers such as return flow from septic fields, irrigation, distribution losses, run-off from surrounding uplands or regional groundwater flow patterns.

4.4.2 Extraction

All the GVS production wells are metered and the extraction totals as reported by Mr. Blaeser for 2004 are provided below.

Well Name	Total Reported Yield for 2004
Antwerp Springs Well 1	$2.4 \times 10^5 \text{ m}^3$
Antwerp Springs Well 2	$2.0 \times 10^5 \text{ m}^3$
Total Antwerp Springs¹	$4.4 \times 10^5 \text{ m}^3$
Coldstream Ranch Well 1	$6.6 \times 10^5 \text{ m}^3$
Coldstream Ranch Well 2	$1.1 \times 10^5 \text{ m}^3$
Total Coldstream Ranch	$7.7 \times 10^5 \text{ m}^3$
TOTAL OF ALL WELLS	$1.2 \times 10^6 \text{ m}^3$

It is possible that considerably more groundwater is extracted for private irrigation purposes, because agricultural land comprises approximately 11 km² of the Study Area and irrigation demands are high. However, an estimated of groundwater extracted for private irrigation has not been made due to lack of information concerning which agricultural properties are serviced with GVS water.

4.4.3 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 summarized in the following table includes the total extraction and total annual recharge estimates for the Study Area.

Catchment Area	Total Annual Recharge	Extraction Based on 2004 Rates	Net Surplus	Utilization Rate
Antwerp Springs	$2.9 \times 10^6 \text{ m}^3/\text{yr}$	$4.4 \times 10^5 \text{ m}^3/\text{yr}$	$2.5 \times 10^5 \text{ m}^3/\text{yr}$	15%
Coldstream Ranch	$7.0 \times 10^6 \text{ m}^3/\text{yr}$	$7.7 \times 10^5 \text{ m}^3/\text{yr}$	$6.2 \times 10^5 \text{ m}^3/\text{yr}$	11%
BOTH AREAS	$7.0 \times 10^6 \text{ m}^3/\text{yr}$	$1.2 \times 10^6 \text{ m}^3/\text{yr}$	$5.8 \times 10^5 \text{ m}^3/\text{yr}$	17%

It should be noted that the Coldstream Ranch catchment area includes the Antwerp Springs catchment area and hence the Total Annual Recharge calculated for the Coldstream Ranch applies to Both Areas. The current utilization rate of water just by RDNO is estimated to be 15% for the Antwerp Springs Wells, 11% by the Coldstream Ranch Wells and 17% total for all four wells.

The above utilization rates do not include the use by other private well owners within the Study Area, in particular agricultural users, which could increase the aquifer utilization rates by a considerable amount. It also does not account for reduction in well yield created by the lowering of available drawdown in wells during drought.

5.0 WELL PROTECTION TOOLKIT

5.1 Step 1 - Community Planning

5.1.1 Initial Kickoff Meeting

The first step of the WPT is to form a Community Planning Committee (CPC). This was accomplished on May 17, 2005 by means of a kickoff meeting held for the project. The meeting was attended by Mr. Al Cotsworth, Manager of Water, Ms. Renee Clark, Senior Water Quality Technologist, and Ms. Tricia Brett, Water Quality Technologist, representing GVS and RDNO, Mr. Kevin Blaeser, Operator with the District of Coldstream, Mr. Vince Nickel, Environmental Health Officer with IHA and Mr. Remi Allard and Ms. Zee Marcolin on behalf of Golder. A representative of MOE was invited to the meeting but was unable to attend. The purpose of the meeting was to review the terms of reference for the investigation and develop an action plan, as well as provide an overview of the WPT and discuss the roles and objectives of the CPC.

During the initial planning meeting it was agreed that the development and implementation of the GWPP must include a wide range of community interests. Local government bodies, citizens, business owners and community groups all have an interest in protecting groundwater in the area for domestic and agricultural use. Initially, however, the CPC would consist of representatives from GVS and RDNO, IHA, the District of Coldstream and Golder and would likely include the people who attended the initial kick-off meeting.

It was decided that the primary focus of the GWPP at this time is technical and does not require the input from the general public. Input from the public will be solicited following the completion of Steps 2 and 3, with additional members added to the CPC at a later date.

The initial objective of the CPC is to understand the technical aspects of the aquifers in the Study Area, prior to embarking on public workshops to solicit stakeholder input. Concerns identified during the kickoff meeting regarding the aquifers included:

- Protection of individual wellhead areas for the municipal production wells;
- Specific water quality issues: nitrate, ammonia and coliform impacts in the shallow wells (Antwerp Well 1 and Coldstream Ranch Well 2) and manganese in the deep wells (Antwerp Well 2 and Coldstream Ranch Well 1);
- Surrounding land use potentially affecting the water quality of the shallow wells;
- The potential for contamination of the shallow aquifer (AS:shallow) at the Antwerp Springs service lot via the old shallow well;
- Groundwater quality issues related to groundwater under the direct influence of surface water (GUDI);

5.1.2 Action Plan and Objectives

The action plan outlined at the kickoff meeting was to first characterize the aquifer systems in the areas of the municipal production wells. This would enable officials to be confident in answering the public's questions during the public consultation process.

The CPC decided that the general objective of the GWPP would be to protect groundwater quality and quantity. More specific objectives and an action plan would be determined once the initial phase of the Study was completed and the aquifers characterized. Tools that would be examined in the future to assist in the protection of the groundwater source would likely focus on public education, strategic land use planning (bylaws, rezoning, etc.), and a more detailed analysis of Best Management Practices in the agricultural community.

5.2 Step 2 - Define Well Protection Areas

5.2.1 General

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.

5.2.2 Modeling Methodology and Limitations

Several methods of time of travel zone analysis exist including: 1) type curves (calculated fixed radius (CFR) method) and analytical equations for the time-of-travel zone extent, 2) analytical groundwater flow models, 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 was beyond the scope of this project.

The CFR method outlined in the WPT was considered the most appropriate means of estimating time of travel zones for the GVS production wells based on the information available.

The CFR method is defined by the following equation:

$$r = \sqrt{\frac{10038 * Q * t}{n * b}}$$

Where:

r = calculated fixed radius around the pumping well dependant on *t* (m)

Q = pumping rate (L/s)

t = travel time (usually in years)

n = aquifer porosity (assumed to be 0.25 for sand and gravel aquifer)

b = aquifer thickness or screen length (m)

The CFR method is a calculation based on simple physical assumptions of the aquifer system. The CFR method assumes the aquifer is uniform and the groundwater velocity prior to pumping is nil. It is generally applicable when: 1) the hydraulic gradient is relatively small; 2) the aquifer is relatively homogeneous; 3) the pumping rate is relatively high; and 4) the pumping well is located at a significant distance from hydrogeologic boundaries. Considering this, the CFR method is considered to be fairly accurate for time of travel zones up to 60 days and somewhat accurate up to one year, as long as a recharge or bedrock boundary is not intersected. The 60-day time of travel is generally accepted as the approximate time required for the renovation of biological pathogens in groundwater.

Estimates of time of travel zones in excess of one year are typically a poor representation of travel time zones as they start to intersect recharge and bedrock boundaries. The CFR method does not account for recharge from surface water bodies (streams, creeks, rivers or lakes) or interferences due to bedrock.

Further limitations of the CFR method are that it does not account for the following:

- hydraulic gradient and the natural flow of groundwater;
- seasonal fluctuations in precipitation;
- interferences due to stratigraphy changes;
- interactions with other wells;
- dispersion, retardation or degradation of contaminants in groundwater; and
- changes in pumping rates, based on daily and seasonal variations controlled by water supply demands and down time due to maintenance.

5.2.3 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 zones for GVS four water wells currently in use. Although the wells in each of the well fields are in close proximity to each other, the time of travel zones for each pair of wells were not calculated together because the wells in each well field are within distinctly different aquifers. The pumping rate used for each well is provided in Table 2, which are the reported maximum recommended pumping rates provided in the corresponding well completion reports (Golder, 2002; Kala, 1998, 1999& 2000).

The results of the 60-day time of travel zone estimations using the CFR method are provided in the following table:

Well Name	Preliminary 60-day Time of Travel Zones
Antwerp Springs Well 1	150 m
Antwerp Springs Well 2	80 m
Coldstream Ranch Well 1	116 m
Coldstream Ranch Well 2	154 m

Note. The results are circular; hence the time of travel zone is the radius in meters with the well at the center.

The extents of the preliminary 60-day time of travel zones for the municipal production wells are shown in Figure 7 and Figure 8. The 1-year, 5-year and 10-year time of travel zones were not calculated. The longer duration time of travel zones using the CFR method are not expected to provide a reliable representation as they do not incorporate the influence of the hydraulic gradient, recharge boundaries or bedrock boundaries.

It is anticipated that the 60-day time of travel zones will not extend beyond the recharge boundary (Coldstream Creek) for Antwerp Springs Well 1 provided that the drawdown within the well does not fall below the base elevation of the Creek and assuming the general absence of confining river bottom sediments (i.e. silt, clay). Should the water level elevation within the pumping well fall below the base elevation of the Coldstream Creek, it is possible that the time of travel zone will extend beyond the creek.

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

6.0 POTENTIAL THREATS TO WATER QUALITY

6.1 Preliminary GUDI Analysis

The Province of British Columbia does not have a regulation to evaluate whether groundwater is considered GUDI. As such, the Ontario Ministry of Environment (OMOE) protocols were used for guidance purposes (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.

Although the OMOE protocol indicates a 50 day horizontal saturated travel time from surface water, we generally use a 60 day travel time as it is more conservative and generally accepted in BC to be as the time require to satisfactorily renovate microbial contaminants.

A review of historical water quality data was beyond the scope of this assessment; however, some details were provided pertaining to Total Coliform and nitrate levels occurring within the shallow wells and this information is included in the preliminary GUDI assessment for the RDNO municipal production wells. Similarly, no information is available concerning the response (if any) of surface water levels as a result of pumping groundwater from the well.

Based on the preliminary criteria above, the following preliminary GUDI assessment is applied to the GVS wells:

- Four criteria of the preliminary GUDI assessment are satisfied for the *Antwerps Spring Well 1* to be flagged as likely a GUDI well. These criteria are: (i) Coldstream Creek is located within the 60-day time of travel zone of *Antwerps Spring Well 1* (ii) *Antwerps Spring Well 1* is drawing water from a formation within approximately 15 m of ground surface, (iii) *Antwerps Spring Well 1* has contained Total Coliforms in the past and (iv) is the hydraulic gradient significant decrease due to pumping of *Antwerps Spring Well 1* as noted by the change flow from the Large Diameter Well. Therefore, it is likely that *Antwerps Spring Well 1* is GUDI.

- Although Coldstream Creek is within the 60-day time of travel zone of *Antwerps Spring Well 2*, it is unlikely that this well is GUDI due to the large clay layer between the creek and AS:deep. No other criteria of the preliminary GUDI assessment applied and therefore *Antwerps Spring Well 2* is likely not GUDI.
- One of the criteria of the preliminary GUDI assessment was satisfied for the *Coldstream Ranch Well 2* to be flagged as likely a GUDI well. The criteria satisfied is that *Coldstream Ranch Well 2* has contained Total Coliform in the past. It also must be noted that although Coldstream Creek is located outside the 60-day time of travel zone of *Coldstream Ranch Well 2*, the well is drawing water from a formation less than 15 m from the ground surface (static level is approximately 6.3 mbgs and the top of the well screen is 9.8 mbgs). The area within the 60-day time of travel zone of *Coldstream Ranch Well 2* is agricultural and appears to be irrigated, which could also enhance infiltration rates and decrease the vertical travel time of contaminants from the ground surface. Based on these criteria, *Coldstream Ranch Well 2* is flagged as potentially GUDI.
- *Coldstream Ranch Well 1* is 200 m from Coldstream Creek and not within the well's 60-day time of travel zone. It is also protected from the creek by a large clay layer between the creek and CR:AQ3 aquifer. No other criteria of the preliminary GUDI assessment applied and therefore *Coldstream Ranch Well 1* is not considered to be GUDI.

Based on the above conditions, Antwerp Springs Well 1 and Coldstream Ranch Well 2 are flagged as potentially GUDI while Antwerp Springs Well 2 and Coldstream Ranch Well 1 are not likely GUDI.

6.2 Land Use within Time of Travel Zones

6.2.1 Antwerp Springs Wells

Land use surrounding the Antwerp Springs Wells is residential and agricultural, with Coldstream Creek flowing close to the wellheads. The residential properties surrounding the wells are all serviced by septic systems.

Due to the depth and confining layer thickness of AS:deep, it is unlikely that land use activities will effect the water quality of Antwerp Springs Well 2 as long as the well is properly sealed and cased. The only foreseeable risk to Antwerp Springs Well 2 identified in Figure 8 is from the neighbouring well (WTN 48118). If this well is not properly sealed or cased, it could present a direct conduit of contaminants to AS:deep.

Antwerp Springs Well 1 does not have the same protection as Antwerp Springs Well 2 and the following risks are identified:

- There are a minimum of five residential septic systems within the calculated 60-day time of travel zone (Figure 8) that could be a source of microbial contaminants as well as nitrates, detergents and other household chemicals to Antwerp Springs Well 1.
- The agricultural land to the north of Coldstream Creek could provide fertilizers, pesticides and microbial contaminants (if raw manure is used) directly into AS:shallow.
- The drainage system on the Antwerp Springs service lot (Figure 4) drains the ditch beside the road and possibly collects surface drainage from areas upslope. There is a potential risk that this drainage system could provide a direct conduit to AS:shallow as there are no check valves between the manholes and the Large Diameter Well. The Large Diameter Well could potentially facilitate reverse flow back into AS:shallow when the Antwerp Springs Well 1 is pumping at rates greater than 500 USgpm. Also, this drainage system is not flood proofed and floodwaters from Coldstream Creek could potentially breach the system.
- Highway 6 traverses through the 60-day time of travel zone. Long-term releases of substances such as road salt, or short-term accidents or spills occurring on Highway 6 could present a risk to groundwater quality. This risk is compounded by the drainage system on the Antwerp Springs service lot. Spills could easily reach the ditch, which could provide direct access to AS:shallow.
- As detailed in Section 6.2.1., Antwerps Springs Well 1 is likely GUDI, suggesting a potential risk of microbial contamination and other constituents originating from Coldstream Creek. For example, the periodic elevated nitrates in Antwerps Springs Well 1 could be a reflection of elevated nitrates in Coldstream Creek due to agricultural runoff.

6.2.2 Coldstream Ranch Wells

Land use surrounding the Coldstream Ranch Wells is residential and agricultural (Figure 9). The residential properties surrounding the wells are all serviced by septic systems.

Due to the depth and confining layer thickness of CS:AQ3, it is unlikely that local land use activities will effect the water quality of Coldstream Ranch Well 1 as long as the well is properly sealed and cased. There have reportedly been some problems of slumping around the Coldstream Ranch Well 1 pumphouse, which could provide a direct conduit to CS:AQ3 if the annular space of the well is disturbed down to CS:AQ3. The other risk to Coldstream Ranch Well 1 is from neighbouring wells constructed within the same aquifer (WTN 446619, 19026 and 49978). If these wells were not properly sealed or cased, they could present a direct conduit of contaminants to CS:AQ3.

Coldstream Ranch Well 2 is constructed within an unconfined, shallow aquifer and the following risks pertaining to the well are as followings:

- There are a number of homes that are serviced by septic systems within the 60-day time of travel zone that could provide a source of microbial contaminants as well as nitrates, detergents and other household chemicals to Coldstream Ranch Well 2.
- Coldstream Ranch Well 2 is surrounded by agricultural land. There are a calving ground, cattle pastures and a silage storage area within the 60-day time of travel zone that could provide microbial contaminants directly into CR:AQ1.
- A number of neighbouring wells (WTN 49912, 19026 and 21499) are located near Coldstream Ranch Well 2 that, if not properly sealed or cased, could provide a direct conduit for contaminants to reach CR:AQ1.

As detailed in Section 6.2.1., Coldstream Ranch Well 2 is likely GUDI, providing a risk of microbial contamination as the aquifer that the well is drawing from is less than 15 m from ground surface.

7.0 CONCLUSIONS AND RECOMMENDATIONS

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

- Antwerp Springs Well 1 is constructed in a localized, shallow, semi-confined to confined aquifer that is associated with the lower slopes of Silver Star Mountain. The preliminary GUDI assessment has identified Antwerp Springs Well 1 as likely being GUDI (or directly influenced by surface water).
- Coldstream Ranch Well 2 is constructed in a localized shallow unconfined aquifer that is associated with the King Edward Creek alluvial fan. The preliminary GUDI assessment has also identified Coldstream Ranch Well 2 as likely being GUDI.

- Antwerp Springs Well 2 and Coldstream Ranch Well 1 are constructed in deep, confined aquifers that could possibly be the same aquifer. These wells were identified as not likely GUDI in the preliminary GUDI assessment.
- The Antwerp Springs service lot contains Antwerp Springs Well 1 and Well 2 and an associated pumphouse. The service lot also contains the Large Diameter Well that was in service prior to Antwerp Springs Well 1 being constructed. The Large Diameter Well, which is currently not used is artesian and flows continually when Antwerp Springs Well 1 is not pumped. The flow from Large Diameter Well reportedly stops when Antwerp Springs Well 1 is pumped at a rate of approximately 500 USgpm or greater.
- A preliminary water balance analysis estimates the annual recharge to all aquifers to be approximately 2.9×10^6 m³/yr at the Antwerp Springs Wells and approximately 7.0×10^6 m³/yr at the Coldstream Ranch Wells.
- The total annual groundwater extraction for the GVS production wells for 2004 based on metering data is 1.2×10^6 m³/yr (4.4×10^5 m³/yr for the Antwerp Springs Wells and 7.7×10^5 m³/yr for the Coldstream Ranch Wells).
- Based on the calculated recharge and extraction estimates, the resultant net surpluses are 2.5×10^5 m³/yr for the Antwerp Springs area and 6.2×10^5 m³/yr at the Coldstream Ranch.
- The percentage of aquifer utilization (based on 2004 water usage data) is estimated to be 15 % for the Antwerp Springs Wells, 11 % for the Coldstream Ranch Wells and a total of 17% for all four GVS production wells. This estimate does not take into account water returned to the aquifer due to reported distribution losses or water utilized by other wells, particularly for irrigation purposes.
- The preliminary 60-day time of travel zone for the four municipal productions wells was estimated using the CFR method. As Antwerp Springs Well 2 and Coldstream Ranch Well 1 are screened within deep, confined aquifers, the land use within the 60-day time of travel zone for these wells, and neighbouring wells constructed in the same aquifer, will not likely effect the water quality provided the wells are properly constructed and sealed. In contrast, the land use within the 60-day time of travel zone for the Antwerp Springs Well 1 and Coldstream Ranch Well 2 could potentially have a large impact on the water quality of these aquifers due to the absence of a protective confining layer.

- Potential water quality threats to Antwerp Springs Well 1 identified within the 60-day time of travel zone are residential septic systems, agricultural land use (crop land), the threat of an accidental chemical spill along Highway 6 and Coldstream Creek. There is also a drainage system on the Antwerp Springs service lot that presents a risk to the shallow aquifer via the Large Diameter Well.
- Potential water quality threats to Coldstream Ranch Well 2 identified within the 60-day time of travel zone are residential septic systems and agricultural land use (calving ground, cattle pastures and a silage storage area) There are also close neighbouring wells of unknown condition which could affect water quality.

The results of the hydrogeological assessment indicate that of the four GVS production wells, the groundwater quality at Antwerp Springs Well 1 and Coldstream Ranch Well 2 are considered to be at the greatest risk of degradation. Coldstream Ranch Well 2 is completed in shallow sediments without an overlying confining layer to protect the aquifer from surface activities such as residential septic systems and agriculture. Although Antwerp Springs Well 1 is semi-confined to confined by a “clayey silt with minor sand” layer, the lateral extents of the confining layer or the protective value of this layer is uncertain. In addition, both wells have been identified as being potentially GUDI due to their shallow nature, the proximity of Antwerp Springs Well 1 to a surface water body and the historical presence of Total Coliform. In contrast, Antwerp Springs Well 2 and Coldstream Ranch Well 1 are considered relatively protected from groundwater degradation due to the presence of a thick clay layer above the aquifer(s).

We understand that the Master Water Plan for the RDNO (NOWA, 2002) recommends that the Coldstream Ranch Wells 1 and 2 be used solely for irrigation purposes in the future. Based on the results of this Study, it is recommended that consideration be given to using only the wells within the deep confined aquifer(s) (Antwerp Springs Well 2 and Coldstream Ranch Well 1) for potable water and using the Shallow Wells (Antwerp Springs Well 1 and Coldstream Ranch Well 2) solely for irrigation purposes. Presumably, treatment may be required to address the reported manganese concerns associated with the deeper wells.

Should this approach be considered, future work should include further characterization of the deep aquifer(s). A characterization study would examine regional information to refine the lateral extents of the aquifer(s), including, geo-chemical analysis to assess the possible link between Antwerp Springs Well 2 and Coldstream Ranch Well 1, should sufficient groundwater chemistry information be available. Information from the characterization study would be used to develop a numerical groundwater flow model. The numerical model would be used to refine the capture zones of Antwerp Springs Well 2 and Coldstream Ranch Well 1.

The information provided from a numerical model would assist GVS – Water in completing further steps in the GWPP in developing management strategies for the aquifer(s). For example, the information could be used to:

- Refine capture zones and time of travel zones where strategies are required to protect the water quality and quantity. An example of protecting water quality would be to ensure all wells developed in the aquifer within the capture zone are properly sealed and cased if still functioning and properly decommissioned if they are no longer in use. An example of protecting water quantity is to restrict any high capacity well development within the capture zones.
- Assist in identifying the most appropriate locations for future wells sites within the deep aquifer(s).

Once a numerical model was completed, the following steps in the WPT could continue:

- Conduct a contaminant inventory (Step 3) to identify potential threats that could impact the municipal production wells. The effort should concentrate on identifying contaminant sources (i.e. septic sources, unknown wells, historical high risk land uses and current potential risks) and potential risks;
- Designate groundwater protection area(s) and develop management strategies (i.e. education and/or land use planning) to protect groundwater within those areas (Step 4);
- Develop a Contingency Plan (Step 5), that would identify short-term and long-term alternative water supply sources in the event of a disruption to the water supply source and an Emergency Response Plan to address potential contamination events; and
- Develop and Evaluate a Groundwater Monitoring Plan (Step 6): this step would consist of an assessment of historical monitoring results, a review of the scope of the current monitoring plan, and making refinements to the monitoring program based on the results of Steps 2 and 3.

If the shallow wells are kept on-line with the municipal distribution system and remain a potable water source, further work required would include:

- Conducting additional analysis to confirm whether the wells are GUDI and identify actions to be carried out in the event that GUDI status is confirmed,
- Refine the capture zones of the shallow wells.

- Conduct a contaminant inventory within the capture zones and continue with the other steps in the GWPP,
- Refurbish the drainage system on the Antwerp Springs lot by routing ditch drainage and general surface drainage away from wells and installing a backflow prevention valve on the Large Diameter Well, and
- Decommissioning the large diameter well.

8.0 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.

9.0 CLOSURE

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

GOLDER ASSOCIATES LTD.


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Senior Hydrogeologist

Reviewed by: Jillian Sacre, M.Sc., P.Geo.
Senior Reviewer, Associate

ZM/RA/JS/jc

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Table 1 - Summary of Well Logs Identified on MOE Well Database in the Study Area

Well Tag Number	Information provided on location	Construction Date	Depth of Bedrock (m)	Well Depth (m)	Static Level (m)	Driller's Estimate of Well Yield (gpm)
1888	n/a	1938	n/a	18.3	16.8	0
2499	n/a	1945	n/a	3.7	0.9	0
8360	n/a	1950	n/a	3.0	n/a	0
8361	n/a	1950	n/a	0.6	0.3	0
8363	n/a	1950	n/a	3.048	1.524	0
8364	n/a	1950	n/a	4.8768	3.048	0
8365	n/a	1950	n/a	2.4	0.9	0
8368	n/a	1950	n/a	1.8	1.5	0
8379	Township 6, Section 23	1950	n/a	3.7	1.8	0
8503	n/a	1950	n/a	n/a	n/a	0
14026	n/a	1953	n/a	7.6	n/a	0
14027	ODYD, Vernon	1953	n/a	8.5	n/a	0
14728	n/a	1956	n/a	4.6	n/a	0
16523	n/a	1960	n/a	5.5	n/a	0
16526	n/a	1960	n/a	4.9	3.4	0
19025	Chalet Well (Coldstream Ranch)	1965	n/a	4.6	1.2	850
19026	n/a	1965	n/a	61.0	n/a	0
21279	Lavington	1968	n/a	30.5	15.8	250
23041	n/a	1969	n/a	61.6	3.0	100
26612	n/a	1972	n/a	28.0	12.2	15
29589	Lavington, Township 6, Section 23	1974	n/a	47.2	21.9	239
30996	On Coldstream Ranch land, ODYD, DL 225, Plan 1216, TS 6, Section 20	1974	n/a	50.6	n/a	1.5
33679	ODYD, Plan 134530, Township 6, Section 22	1975	n/a	51.8	n/a	0
39359	Out Hwy 6 from Vernon, Township 6, Section 15	1978	n/a	67.1	n/a	100
43926	Hwy 6, Lavington, Plan 21329, Lot 1, Township 6, Section 23	1979	n/a	15.2	3.4	15
43927	Hwy 6, Lavington, Plan 21329, Lot 1, Township 6, Section 23	1979	n/a	47.2	2.4	15
44255	Buchanan Rd, Coldstream, Plan 1216, Lot 239, Tp 6, Section 20	1980	n/a	18.3	n/a	4
46266	Buchanan Rd, Coldstream, Plan 1216, Lot 232, Section 20	1980	39.6	109.7	3.0	10
46619	ODYD, DL 57, Plan B1299, Lot B	1980	n/a	53.3	1.2	0
48118	School Rd, ODYD, Plan 18721, Lot 2, Township 6, Section 23	1981	n/a	64.0	2.7	0
49912	ODYD, DL 57, Plan 29697, Lot A, TS 6, Section 17	1982	n/a	53.6	6.1	0
49978	SE corner of Ranch, ODYD, DL 57, Plan 29697, Lot A, TS 6, Section 17	1982	n/a	63.7	6.1	0
51248	ODYD, Plan 18721, Lot 1, TS 6, Section 24	1982	n/a	59.8	7.3	40
58896	7219 Brewer Rd, ODYD, Plan 1429, Lot 60, Township 6, Section 15	1989	n/a	61.0	3.4	60
62339	7649 Buchanan Road, Sec 20/21, Plan 1216, Lot 225, TS 6, Section 20	1990	n/a	15.5	4.0	50
62341	Hill Drive, ODYD, DL 12, Plan 548, Lot 54, TS 6, Section 24	1973	2.1	48.8	11.6	20
62739	RR #1 Vernon	n/a	n/a	38.7	n/a	40
62856	6652 Learmouth Rd, ODYD, Plan 38750, Lot 1, TS 6, Section 23	1993	n/a	35.1	n/a	30

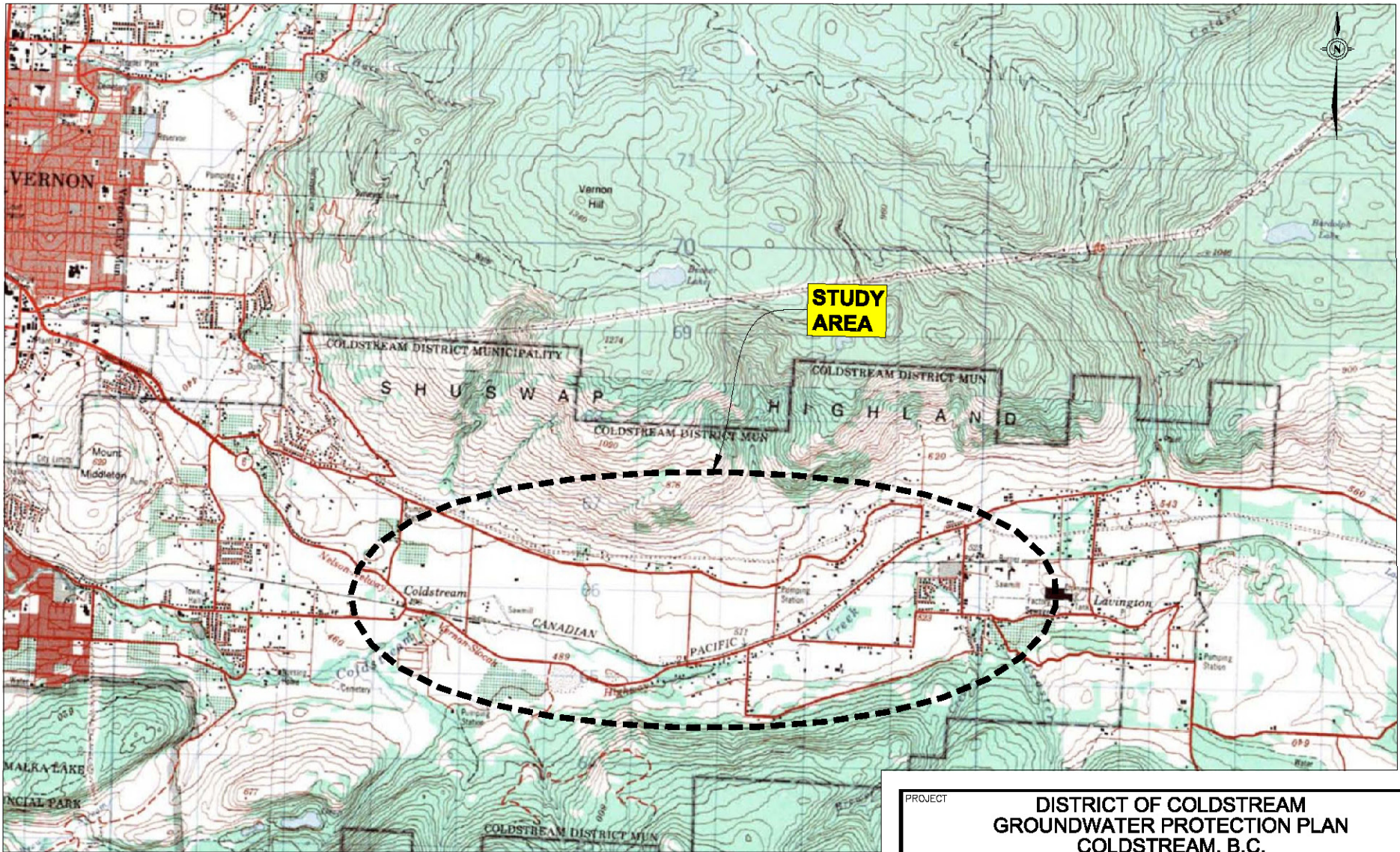
Note: Approximate location also provided in Figure 3

**Table 2 - Summary of Municipal Well Information
Coldstream, B.C.**

WTN	RDNO Designation	Approximate Location in District of Coldstream	Aquifer Designation and Type	Construction Date	Screen Top	Screen Bottom	Well Bottom	Static Level	Maximum Pumping Rate	Maximum Pumping Rate	Transmissivity (T)		
											From SC ³	Reported	Aqtasolv
				year	m	m	m	m	USgpm	L/s	m ² /day	m ² /day	m ² /day
n/a	Antwerp Springs Well 1	School Road & Hwy 6, Lavington	AS:shallow semiconfined/unconfined	July 1998	8.5	13.3	13.3	1.2	650	41.0		216	1360
n/a	Antwerp Springs Well 2	School Road & Hwy 6, Lavington	AS:deep confined	Nov. 1998	57.0	62.2	62.2	3.9	900	56.8		2840	2400
47818	Coldstream Ranch Well 1	Coldstream Ranch, Hwy 6 & Kal. Lake Road	CR:AQ3 confined	1981	44.0	49.4	49.4	0.0	1600	100.9		n/a	265
51386	Coldstream Ranch Well 2	Coldstream Ranch, south of Creek	CR:AQ1 and CR:AQ2 unconfined	1982	9.8	23.9	23.9	6.3	1000	63.1	2800 - 3200	n/a	n/a

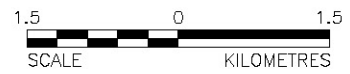
Notes:

1. The well locations are the approximate locations provided by the MWLAP groundwater well database and available reports.
2. From top of casing.
3. Based on $T = 15.3 (Q/(h_o-h))^{0.67}$ for confined aquifers (Fetter, 2001) and $T = 1500 (ho-h)$ where (ho-h) is in Usgpm/ft for unconfined wells (Driscoll, 2003).



PROJECT
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 GROUNDWATER PROTECTION PLAN
 COLDSTREAM, B.C.**

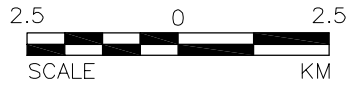
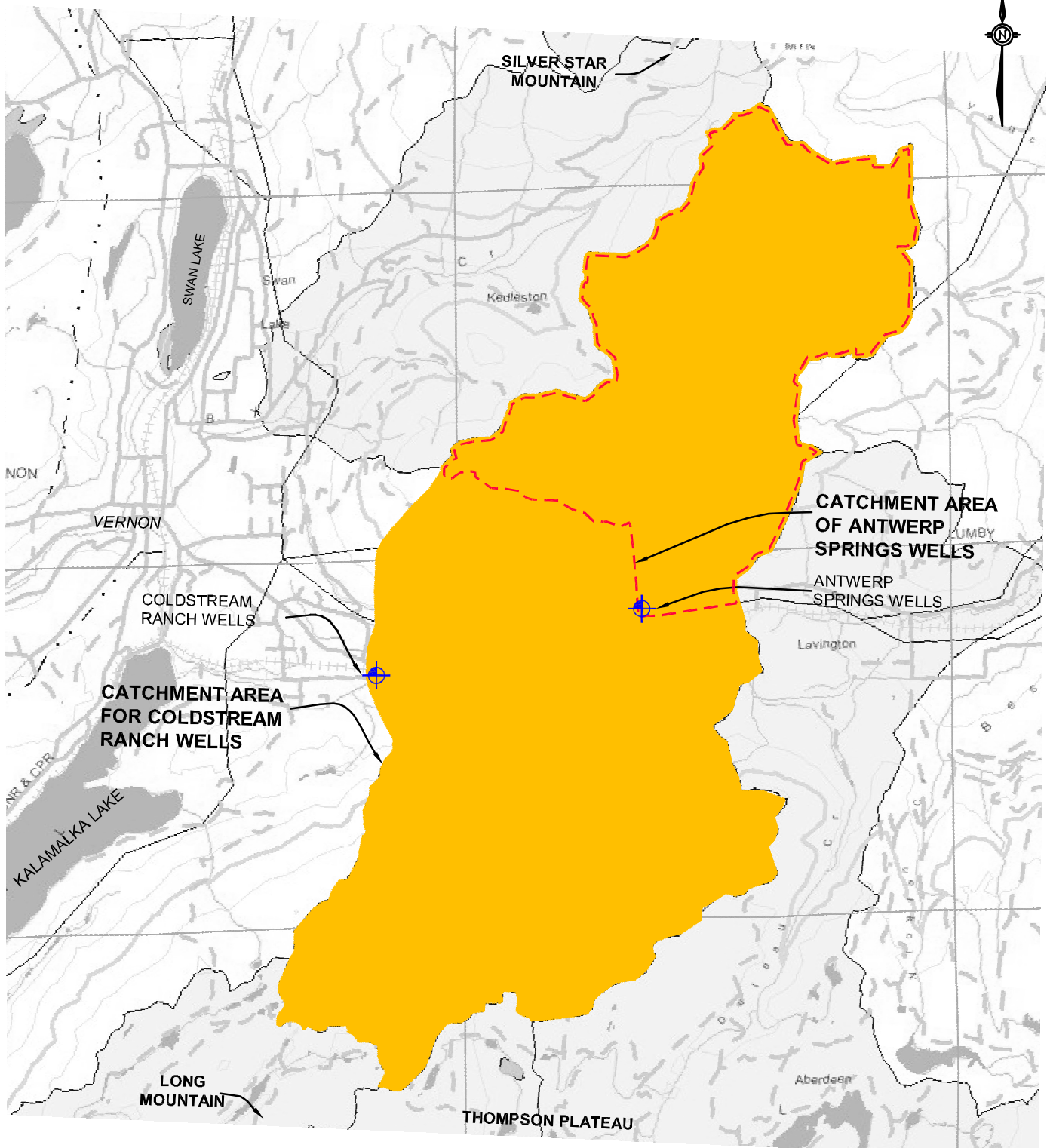
TITLE
KEY PLAN & STUDY AREA






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REVIEW			


FIGURE: 1

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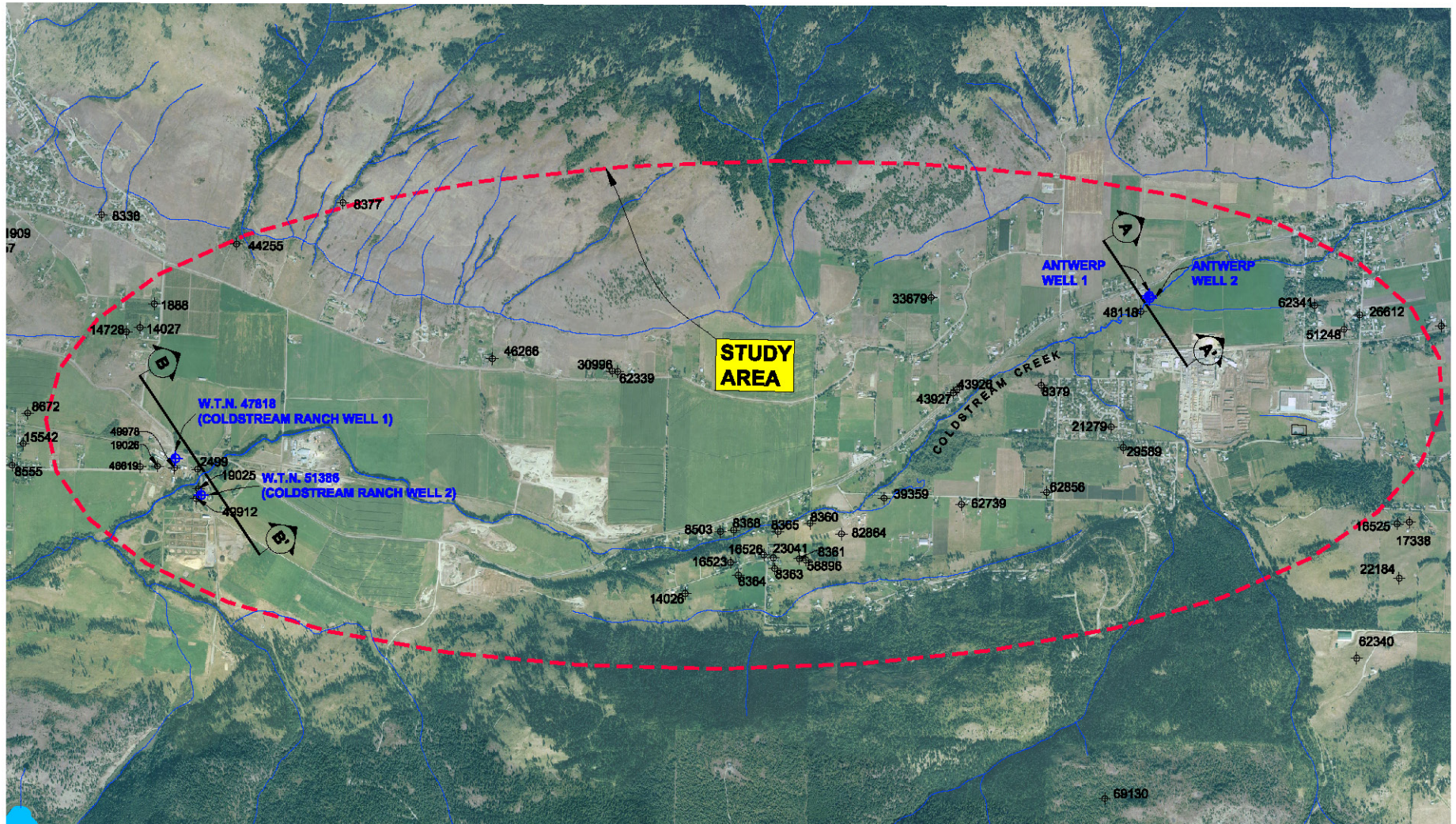


LEGEND



-  MUNICIPAL WELLS
-  CATCHMENT AREA OF COLDSTREAM CREEK INFLUENCING ANTWERP SPRINGS WELLS
-  CATCHMENT AREA OF COLDSTREAM CREEK TO THE COLDSTREAM RANCH WELLS



PROJECT	DISTRICT OF COLDSTREAM GROUNDWATER PROTECTION PLAN COLDSTREAM, B.C.			
TITLE	CATCHMENT AREAS CONTRIBUTING RECHARGE TO LOCAL AQUIFERS			
 Kelowna, BC	PROJECT No. 05-1440-101(2000)	FILE No. 051440101_2000-2.dwg	FIGURE: 2	
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	CADD JC 16/JAN/06			
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REVIEW				

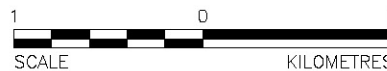
DRAWING REFERENCE: BASEMAP FROM M.O.E.



LEGEND

-  MUNICIPAL WELL
-  WELL TAG NUMBER (MOE WATER WELL DATABASE)

-   CROSS SECTION LOCATION



DRAWING REFERENCE: WELL LOCATIONS FROM M.O.E., ORTHOPHOTO PROVIDED BY CLIENT.

PROJECT REGIONAL DISTRICT OF NORTH OKANAGAN
GROUNDWATER PROTECTION PLAN
COLDSTREAM, B.C.

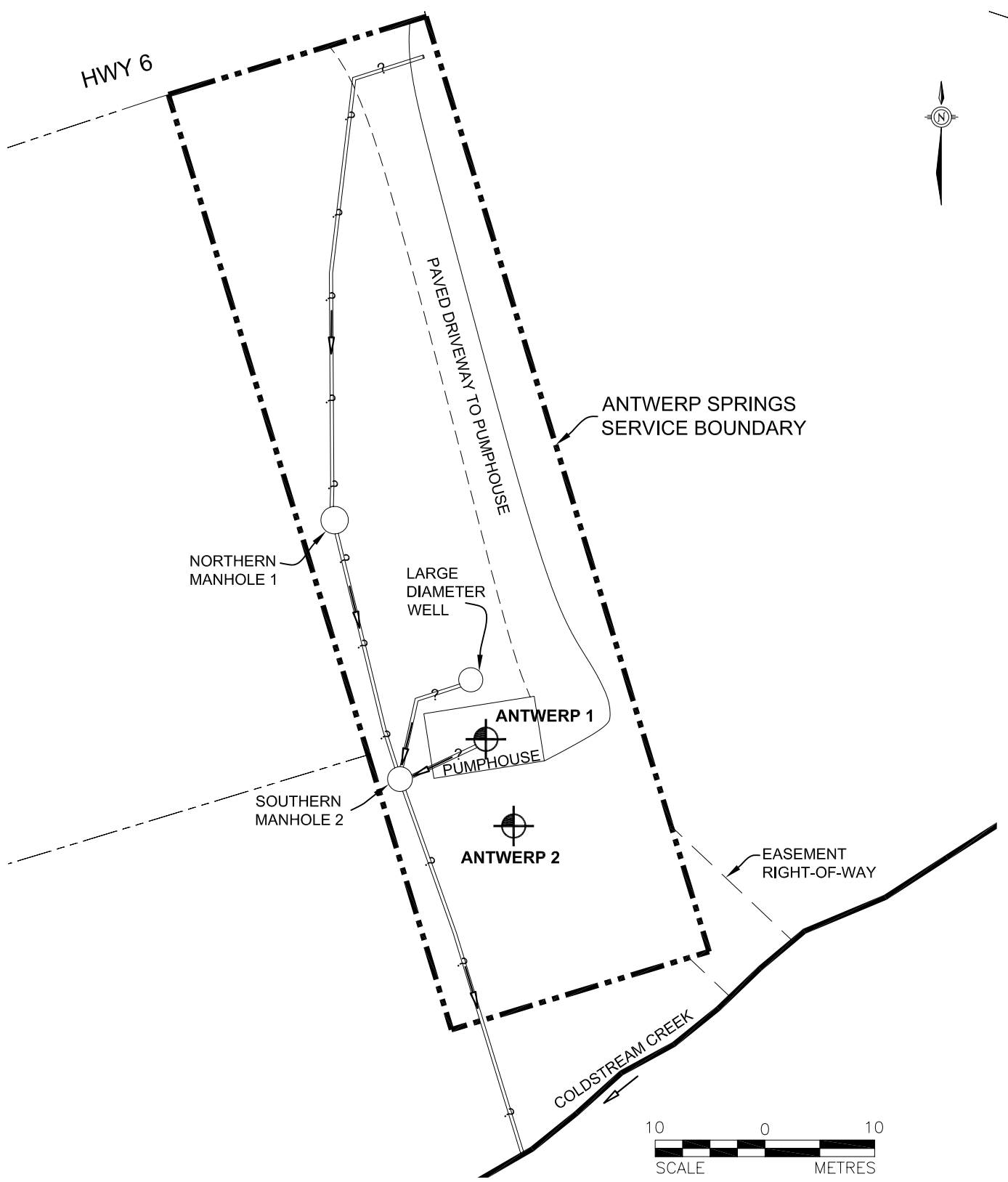
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**WATER WELL LOCATIONS
& CROSS SECTION PLAN**



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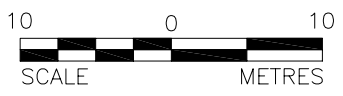
FIGURE: 3

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	MUNICIPAL WELL (APPROX. LOCATION)
	PROPERTY LINE
	FLOW DIRECTION
	DRAIN PIPE (LOCATION APPROX.)

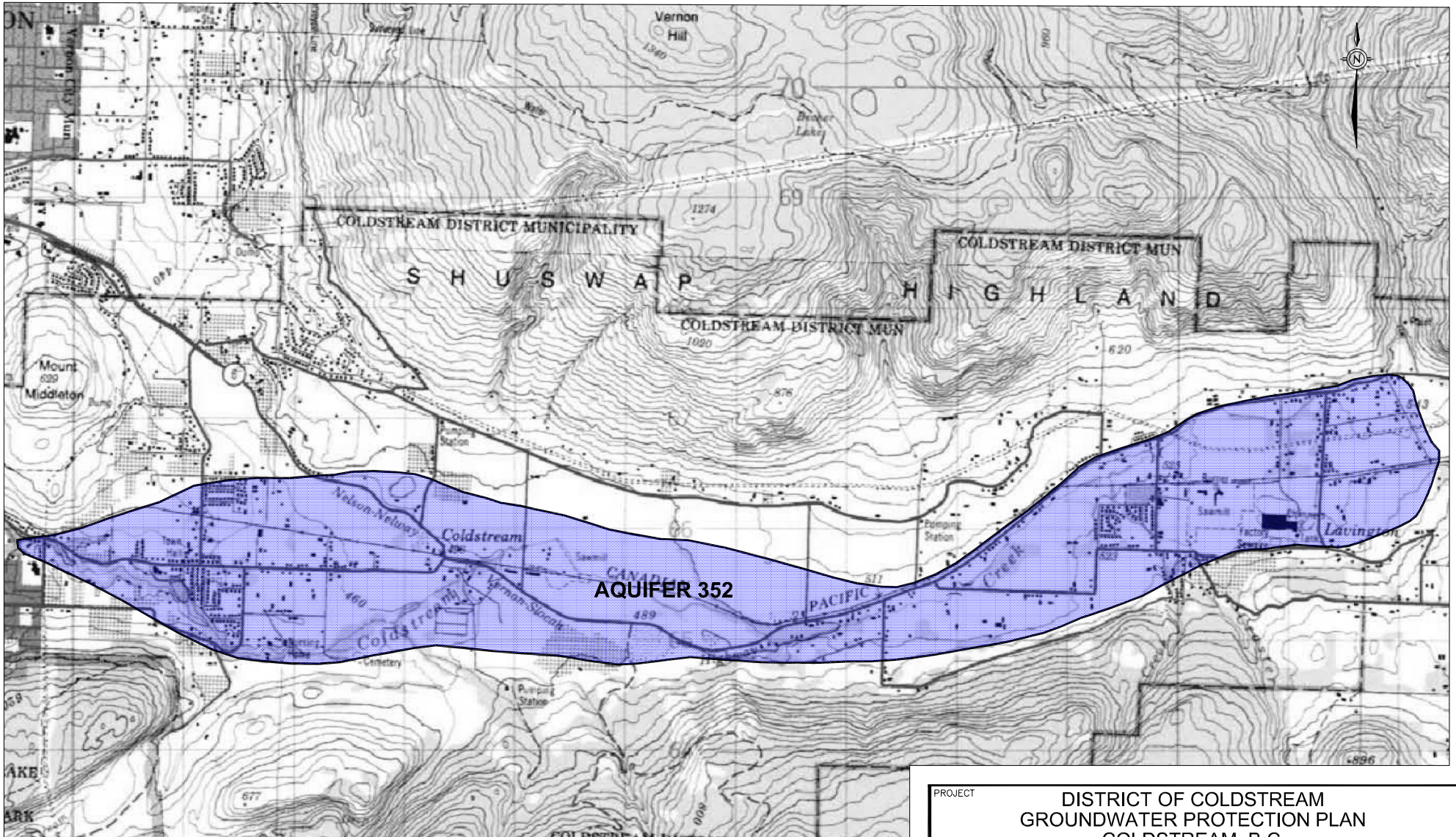


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TITLE		PLAN OF ANTWERP SPRINGS SERVICE LOT	
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REVIEW			




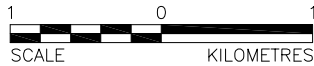
FIGURE: 4

DRAWING REFERENCE: LEGAL DATA FILE: GOLDER CADASTRAL BASE.DWG



LEGEND

 AREA OF AQUIFER 352 AS DEFINED BY M.O.E.



PROJECT DISTRICT OF COLDSTREAM
GROUNDWATER PROTECTION PLAN
COLDSTREAM, B.C.

TITLE
EXTENT OF AQUIFER 352



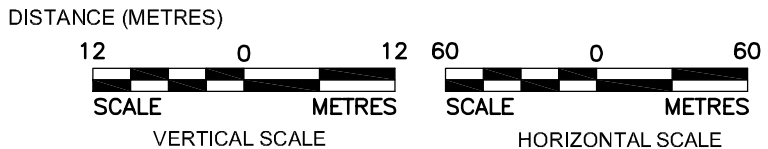
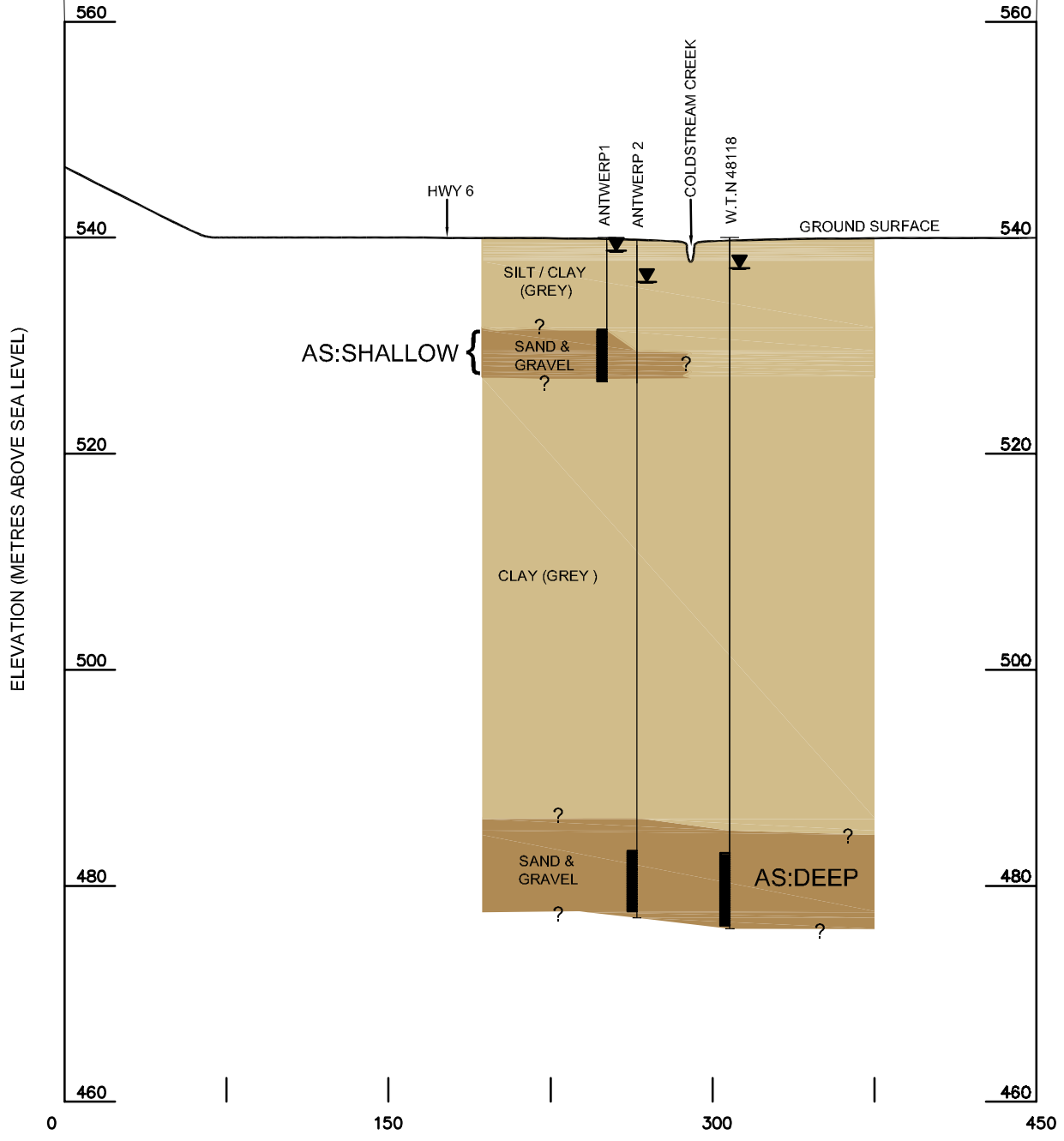
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CADD	JG 22/JUNE/05		
CHECK			
REVIEW			

FIGURE: 5

LOOKING EAST

NORTH SOUTH

A A'



LEGEND

- ? INFERRED STATIGRAPHY CHANGE
- ▼ REPORTED STATIC WATER LEVEL
- ▬ SCREEN INTERVAL

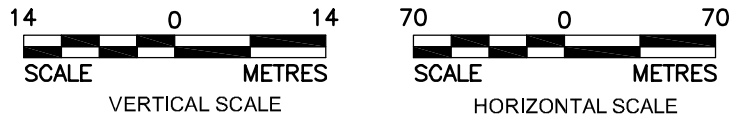
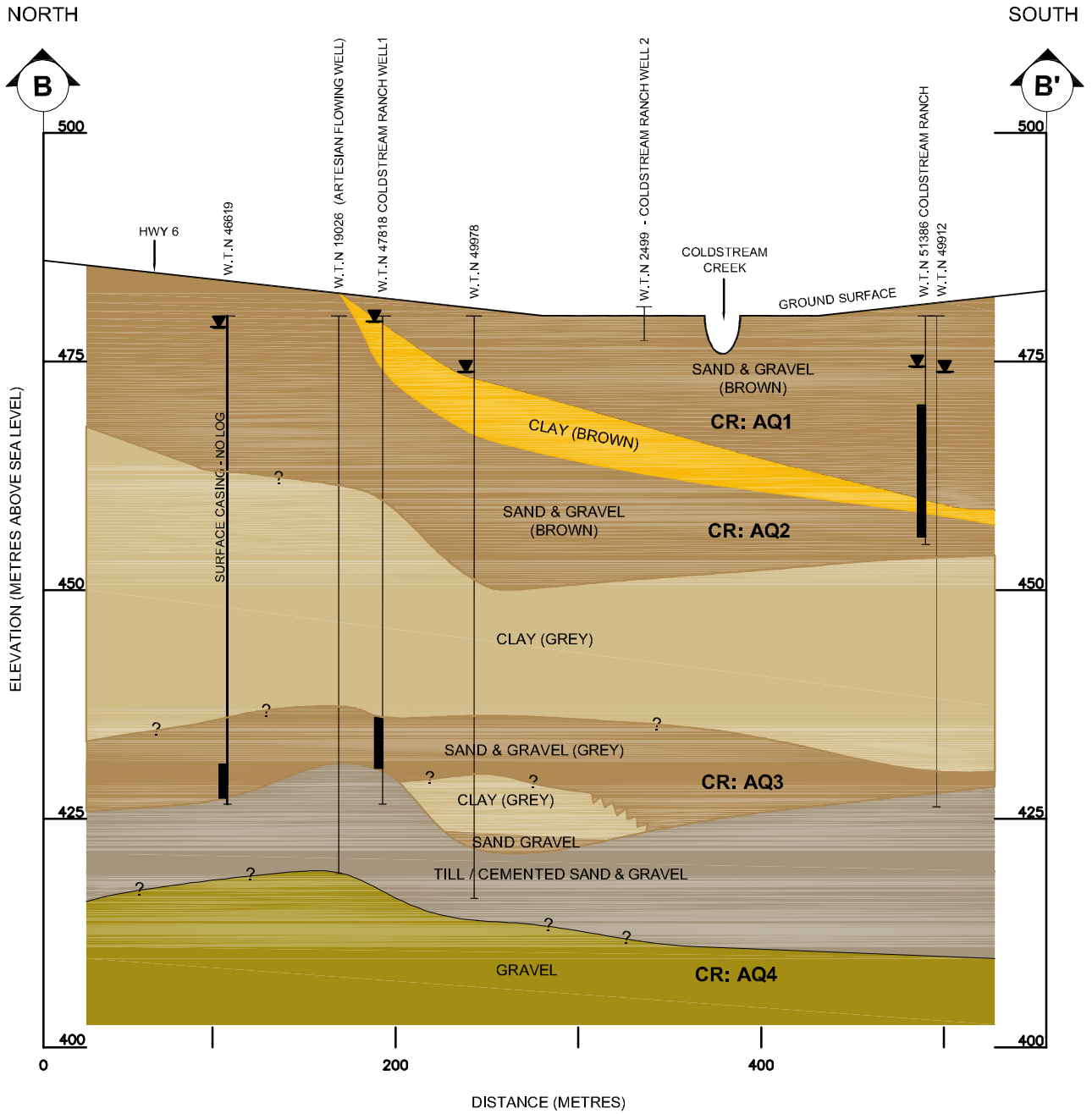
NOTE: THIS DIAGRAM IS AN INTERPRETATION OF THE PROVINCIAL TRIM MAP (20m CONTOURS), VISUAL OBSERVATIONS, AVAILABLE WELL LOGS, REPORTED STATIC LEVELS AND AVAILABLE REPORTS.

PROJECT REGIONAL DISTRICT OF NORTH OKANAGAN GROUNDWATER PROTECTION PLAN COLDSTREAM, B.C.				
TITLE CROSS SECTION A-A' ANTWERP SPRINGS WELLS NORTH TO SOUTH				
 Golder Associates Kelowna, BC	PROJECT No. 05-1440-101 (2000)		FILE No. 051440101_2000-6-7s.dwg	
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	CHECK			
REVIEW				

FIGURE: 6

N:\Active\Year 2005\440\051-440101\Figures\ Drawing file: 051440101_2000-6-7s.dwg Feb 23, 2006 - 4:16pm

LOOKING EAST



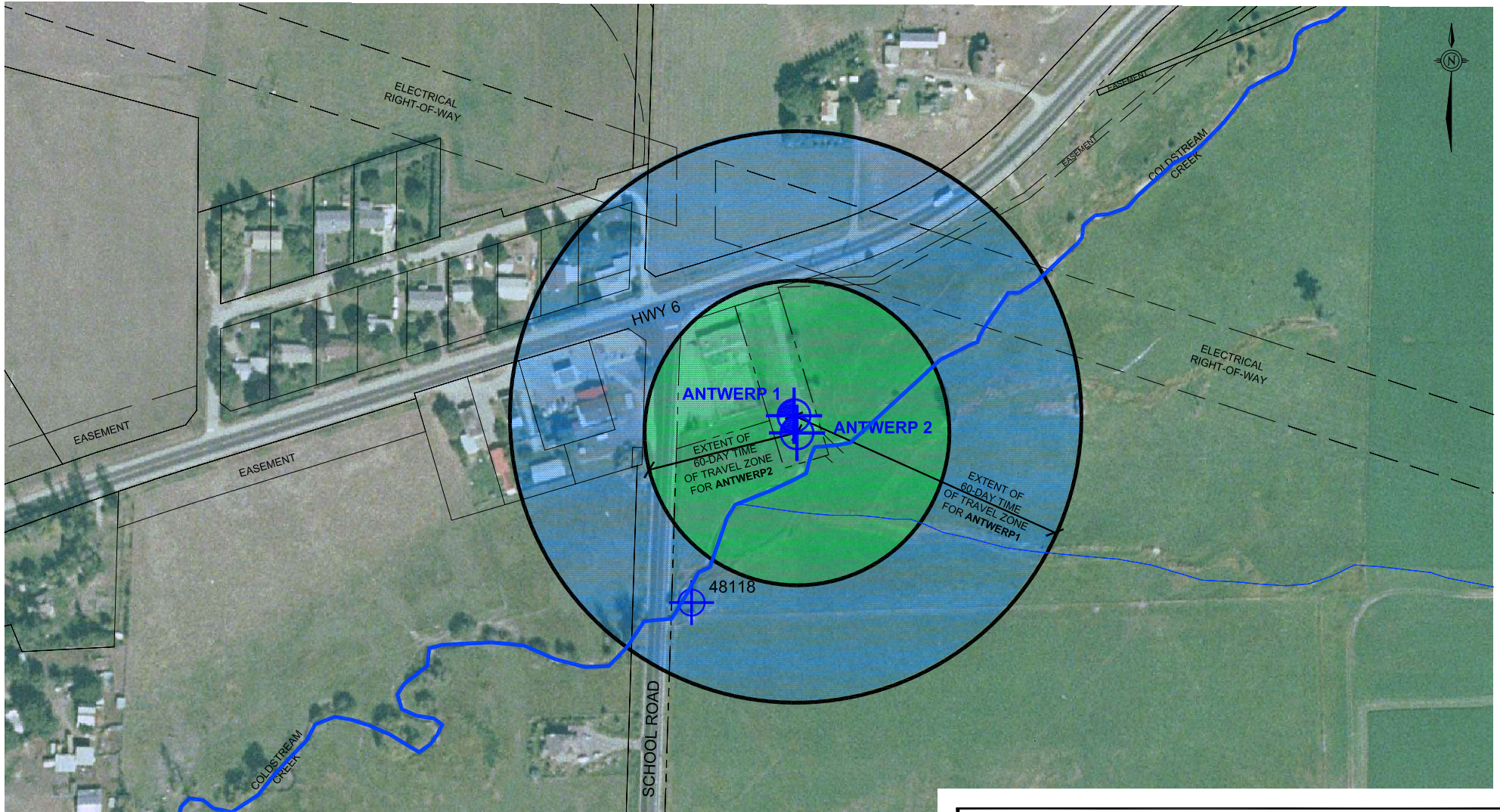
- LEGEND**
- ? INFERRED STATIGRAPHY CHANGE
 - ▼ REPORTED STATIC WATER LEVEL
 - ▬ SCREEN INTERVAL

NOTE: THIS DIAGRAM IS AN INTERPRETATION OF THE PROVINCIAL TRIM MAP (20m CONTOURS), VISUAL OBSERVATIONS, AVAILABLE WELL LOGS, REPORTED STATIC LEVELS AND AVAILABLE REPORTS.





PROJECT	REGIONAL DISTRICT OF NORTH OKANAGAN GROUNDWATER PROTECTION PLAN COLDSTREAM, B.C.		
TITLE	CROSS SECTION B-B' COLDSTREAM RANCH WELLS NORTH TO SOUTH		
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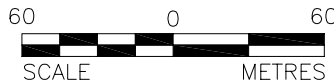


FIGURE: 7




LEGEND

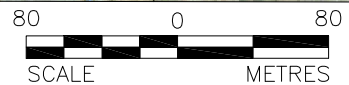
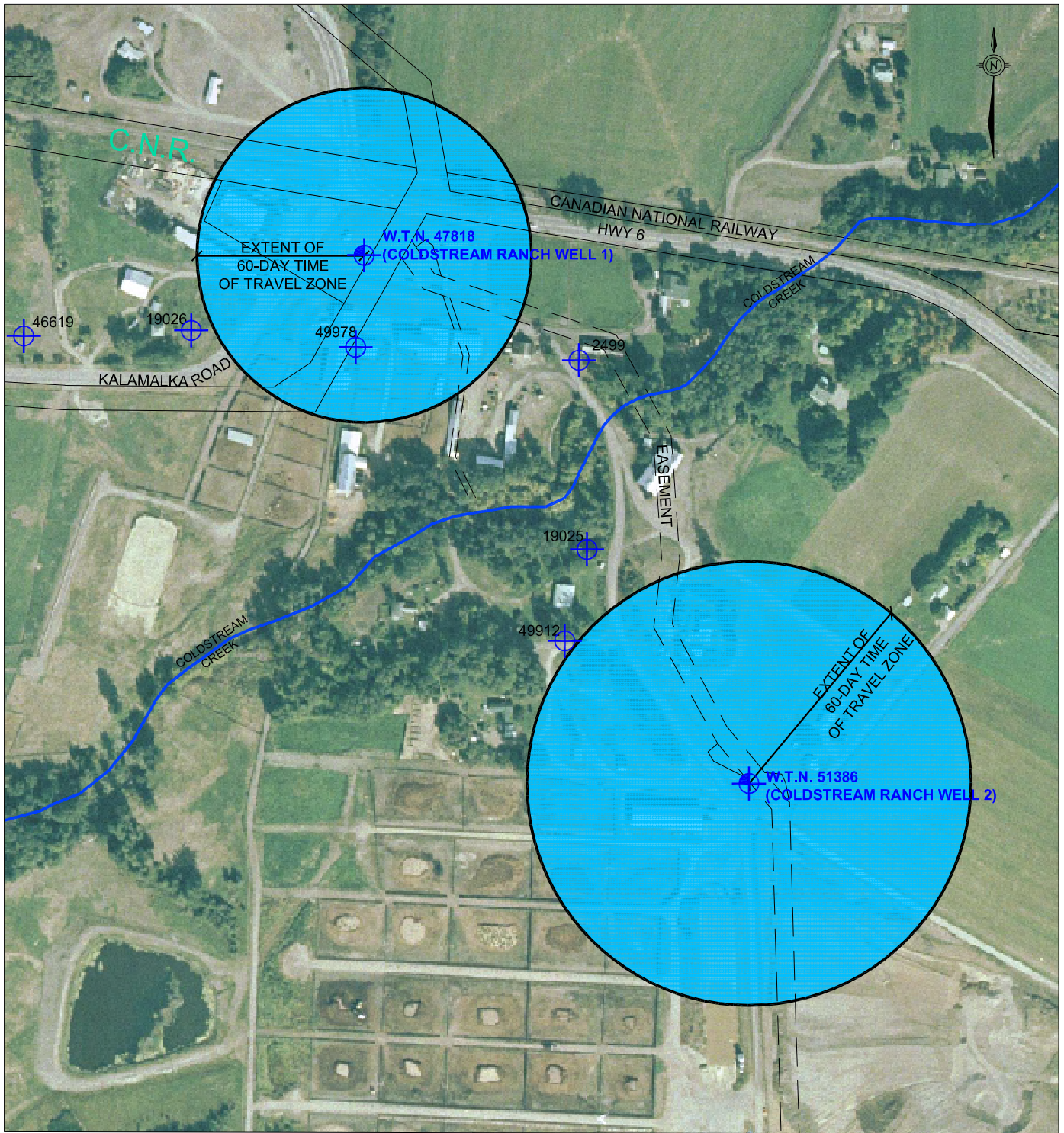
-  MUNICIPAL WELL
-  WELL TAG NUMBER (MWLAP SITE REGISTRY)
-  60-DAY TIME OF TRAVEL ZONE (C.F.R.) OF ANTWERP 1
-  60-DAY TIME OF TRAVEL ZONE (C.F.R.) OF ANTWERP 2






DRAWING REFERENCE: WELL LOCATIONS FROM M.O.E., ORTHOPHOTO PROVIDED BY CLIENT.

PROJECT		DISTRICT OF COLDSTREAM GROUNDWATER PROTECTION PLAN COLDSTREAM, B.C.			
TITLE		PRELIMINARY 60-DAY TIME OF TRAVEL ZONES FOR THE ANTWERP SPRINGS WELLS			
PROJECT	05-1440-101(2000)	FILE No.	051440101_2000-8-9.dwg		
DESIGN	ZM	16/JAN/05	SCALE	1:3,000	REV. 0
CADD	JG	16/JAN/05			
CHECK					
REVIEW					
 Kelowna, B.C.			FIGURE: 8		


N:\Active\2005\1440 - Kelowna\05-1440-101 Coldstream GWPP\Figures\ Drawing file: 051440101_2000-8-9.dwg Mar 23, 2006 - 1:36pm



LEGEND

-  MUNICIPAL WELL
-  WELL TAG NUMBER (MWLAP SITE REGISTRY)
-  60-DAY TIME OF TRAVEL ZONE (C.F.R.)

DRAWING REFERENCE: WELL LOCATIONS FROM M.O.E., ORTHOPHOTO PROVIDED BY CLIENT.

PROJECT	DISTRICT OF COLDSTREAM GROUNDWATER PROTECTION PLAN COLDSTREAM, B.C.				
TITLE	PRELIMINARY 60-DAY TIME OF TRAVEL ZONES FOR THE COLDSTREAM RANCH WELLS				
 Golder Associates Kelowna, BC	PROJECT No.	05-1440-101(2000)	FILE No.	051440101_2000-8-9.dwg	
	DESIGN	ZM	16/JAN/06	SCALE	1:4,000 REV. 0
	CADD	JG	16/JAN/06		
	CHECK				
REVIEW					
				FIGURE: 9	

APPENDIX I

DRILLER'S WELL LOGS USED IN STUDY



Report 1 - Detailed Well Record

<p>Well Tag Number: 1888</p> <p>Owner: S KAICEY</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): 082L025131 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 Well Depth: 60.0 feet Elevation: 0 Bedrock Depth: UNK feet</p>	<p>Construction Date: 1938-01-01 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) Artesian Flow: Static Level: 55 feet</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>Surface Seal Flag: Surface Seal Material: Surface Seal Method: Surface Seal Depth: Surface Seal Thickness:</p> <p>Lithology Info Flag: Pump Test Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM): Site Info Details: Other Info Flag: Other Info Details:</p>
<p>GENERAL REMARKS:</p> <p>From 0 to 0 Ft. NO LOG- MOSTLY SAND, QUICKSAND AT BOTTOM</p>	

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Report 1 - Detailed Well Record

<p>Well Tag Number: 2499</p> <p>Owner: COLDSTREAM RANCH</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): 082L025113 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 Well Depth: 12.0 feet Elevation: 0 Bedrock Depth: UNK feet</p>	<p>Construction Date: 1945-01-01 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) Artesian Flow: Static Level: 3 feet</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>Surface Seal Flag: Surface Seal Material: Surface Seal Method: Surface Seal Depth: Surface Seal Thickness:</p> <p>Lithology Info Flag: Pump Test Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM): Site Info Details: Other Info Flag: Other Info Details:</p>
<p>GENERAL REMARKS:</p> <p>From 0 to 12 Ft. SAND & PEBBLE SIZED GRAVEL</p>	

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Report 1 - Detailed Well Record

<p>Well Tag Number: 8360</p> <p>Owner: W MCPHEE</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): 082L025123 Well: 1</p> <p>Class of Well: Subclass of Well: Orientation of WELL: Status of Well: New Well Use: Irrigation Observation Well Number: Observation Well Status: Construction Method: Dug Diameter: 0.0 inches Well Depth: 10.0 feet Elevation: 0 Bedrock Depth: UNK feet</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) Artesian Flow: Static Level: feet</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>Surface Seal Flag: Surface Seal Material: Surface Seal Method: Surface Seal Depth: Surface Seal Thickness:</p> <p>Lithology Info Flag: Pump Test Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM): Site Info Details: Other Info Flag: Other Info Details:</p>
<p>GENERAL REMARKS: NO DATA</p> <p>From 0 to 0 Ft. NO LOG</p>	

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Report 1 - Detailed Well Record

<p>Well Tag Number: 8361</p> <p>Owner: KUARNT</p> <p>Address:</p> <p>Area: VERNON</p> <p>WELL LOCATION:</p> <p>OSOYOOS (ODYD) Land District District Lot: Plan: Lot: Township: Section: Range: Indian Reserve: Meridian: Block: Quarter: Island</p> <p>BCGS Number (NAD 27): 082L025123 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 Well Depth: 2.0 feet Elevation: 0 Bedrock Depth: UNK feet</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) Artesian Flow: Static Level: 1 feet</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>Surface Seal Flag: Surface Seal Material: Surface Seal Method: Surface Seal Depth: Surface Seal Thickness:</p> <p>Lithology Info Flag: Pump Test Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM): Site Info Details: Other Info Flag: Other Info Details:</p>
<p>GENERAL REMARKS:</p> <p>From 0 to 2 Ft. SAND</p>	

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Report 1 - Detailed Well Record

<p>Well Tag Number: 8364</p> <p>Owner: B HARRER</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): 082L025123 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: Dug Diameter: 0.0 inches Well Depth: 16.0 feet Elevation: 0 Bedrock Depth: UNK feet</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) Artesian Flow: Static Level: 10 feet</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>Surface Seal Flag: Surface Seal Material: Surface Seal Method: Surface Seal Depth: Surface Seal Thickness:</p> <p>Lithology Info Flag: Pump Test Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM): Site Info Details: Other Info Flag: Other Info Details:</p>
<p>GENERAL REMARKS:</p> <p>From 0 to 0 Ft. NO LOG- SAND & GRAVEL</p>	

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Report 1 - Detailed Well Record

<p>Well Tag Number: 8365</p> <p>Owner: NICK SAWKA</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): 082L025123 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: Dug Diameter: 0.0 inches Well Depth: 8.0 feet Elevation: 0 Bedrock Depth: UNK feet</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) Artesian Flow: Static Level: 3 feet</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>Surface Seal Flag: Surface Seal Material: Surface Seal Method: Surface Seal Depth: Surface Seal Thickness:</p> <p>Lithology Info Flag: Pump Test Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM): Site Info Details: Other Info Flag: Other Info Details:</p>
<p>GENERAL REMARKS:</p> <p>From 0 to 8 Ft. GRAVEL</p>	

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Report 1 - Detailed Well Record

<p>Well Tag Number: 8368</p> <p>Owner: T INOUYE</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): 082L025123 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: Dug Diameter: 0.0 inches Well Depth: 6.0 feet Elevation: 0 Bedrock Depth: UNK feet</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) Artesian Flow: Static Level: 5 feet</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>Surface Seal Flag: Surface Seal Material: Surface Seal Method: Surface Seal Depth: Surface Seal Thickness:</p> <p>Lithology Info Flag: Pump Test Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM): Site Info Details: Other Info Flag: Other Info Details:</p>
<p>GENERAL REMARKS:</p> <p>From 0 to 6 Ft. CLAY</p>	

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Report 1 - Detailed Well Record

<p>Well Tag Number: 8379</p> <p>Owner: M SEVHAN</p> <p>Address:</p> <p>Area: VERNON</p> <p>WELL LOCATION: OSOYOOS (ODYD) Land District District Lot: Plan: Lot: Township: 6 Section: 23Range: Indian Reserve: Meridian: Block: Quarter: Island BCGS Number (NAD 27): 082L025142 Well: 1</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: Dug Diameter: 0.0 inches Well Depth: 12.0 feet Elevation: 0 Bedrock Depth: UNK feet</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) Artesian Flow: Static Level: 6 feet</p> <p>Water Utility: N Water Supply System Name: Water Supply System Well Name:</p> <p>Surface Seal Flag: N Surface Seal Material: Surface Seal Method: Surface Seal Depth: Surface Seal Thickness:</p> <p>Lithology Info Flag: N Pump Test Info Flag: N File Info Flag: N Sieve Info Flag: N Screen Info Flag: N EMS ID: Water Chemistry Info Flag: N Field Chemistry Info Flag: Site Info (SEAM): N Site Info Details: Other Info Flag: Other Info Details:</p>
<p>GENERAL REMARKS:</p> <p>From 0 to 12 Ft. MOSTLY HARDPAN</p>	

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Report 1 - Detailed Well Record

<p>Well Tag Number: 8503</p> <p>Owner: V AGNEW</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): 082L025123 Well: 10</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: Unknown Constru Diameter: 0.0 inches Well Depth: 0.0 feet Elevation: 0 Bedrock Depth: UNK feet</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) Artesian Flow: Static Level: feet</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>Surface Seal Flag: Surface Seal Material: Surface Seal Method: Surface Seal Depth: Surface Seal Thickness:</p> <p>Lithology Info Flag: Pump Test Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM): Site Info Details: Other Info Flag: Other Info Details:</p>
<p>GENERAL REMARKS: NO DATA</p> <p>From 0 to 0 Ft. NO LOG</p>	

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Report 1 - Detailed Well Record

<p>Well Tag Number: 14026</p> <p>Owner: H VANECK</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): 082L025123 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: Dug Diameter: 0.0 inches Well Depth: 25.0 feet Elevation: 0 Bedrock Depth: UNK feet</p>	<p>Construction Date: 1953-01-01 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) Artesian Flow: Static Level: feet</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>Surface Seal Flag: Surface Seal Material: Surface Seal Method: Surface Seal Depth: Surface Seal Thickness:</p> <p>Lithology Info Flag: Pump Test Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag: EMS ID: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM): Site Info Details: Other Info Flag: Other Info Details:</p>
<p>GENERAL REMARKS:</p> <p>From 0 to 25 Ft. MOSTLY BLUE CLAY & ROCK HARDPAN</p>	

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Report 1 - Detailed Well Record

<p>Well Tag Number: 14027</p> <p>Owner: J C HICKOLI</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): 082L025131 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: Unknown Constru Diameter: 0.0 inches Well Depth: 28.0 feet Elevation: 0 Bedrock Depth: UNK feet</p>	<p>Construction Date: 1953-01-01 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) Artesian Flow: Static Level: feet</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>Surface Seal Flag: Surface Seal Material: Surface Seal Method: Surface Seal Depth: Surface Seal Thickness:</p> <p>Lithology Info Flag: Pump Test Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM): Site Info Details: Other Info Flag: Other Info Details:</p>
<p>GENERAL REMARKS:</p> <p>From 0 to 0 Ft. NO LOG- MOSTLY SAND & SANDY LOAM</p>	

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Report 1 - Detailed Well Record

<p>Well Tag Number: 14728</p> <p>Owner: ERIC NICKOLI</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): 082L024242 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: Dug Diameter: 0.0 inches Well Depth: 15.0 feet Elevation: 0 Bedrock Depth: UNK feet</p>	<p>Construction Date: 1956-01-01 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) Artesian Flow: Static Level: feet</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>Surface Seal Flag: Surface Seal Material: Surface Seal Method: Surface Seal Depth: Surface Seal Thickness:</p> <p>Lithology Info Flag: Pump Test Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag: EMS ID: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM): Site Info Details: Other Info Flag: Other Info Details:</p>
<p>GENERAL REMARKS:</p> <p>From 0 to 0 Ft. NO LOG- CLAY</p>	

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Report 1 - Detailed Well Record

<p>Well Tag Number: 16523</p> <p>Owner: A HONEYMAN</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): 082L025123 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 Well Depth: 18.0 feet Elevation: 0 Bedrock Depth: UNK feet</p>	<p>Construction Date: 1960-01-01 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) Artesian Flow: Static Level: feet</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>Surface Seal Flag: Surface Seal Material: Surface Seal Method: Surface Seal Depth: Surface Seal Thickness:</p> <p>Lithology Info Flag: Pump Test Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM): Site Info Details: Other Info Flag: Other Info Details:</p>
<p>GENERAL REMARKS:</p> <p>From 0 to 2 Ft. TOPSOIL From 2 to 10 Ft. QUICKSAND From 10 to 18 Ft. HARDPAN</p>	

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Report 1 - Detailed Well Record

<p>Well Tag Number: 16526</p> <p>Owner: R ROTH</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): 082L025123 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: Dug Diameter: 0.0 inches Well Depth: 16.0 feet Elevation: 0 Bedrock Depth: UNK feet</p>	<p>Construction Date: 1960-01-01 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) Artesian Flow: Static Level: 11 feet</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>Surface Seal Flag: Surface Seal Material: Surface Seal Method: Surface Seal Depth: Surface Seal Thickness:</p> <p>Lithology Info Flag: Pump Test Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM): Site Info Details: Other Info Flag: Other Info Details:</p>
<p>GENERAL REMARKS:</p> <p>From 0 to 3 Ft. TOPSOIL From 3 to 11 Ft. SAND & GRAVEL From 11 to 13 Ft. HARDPAN From 13 to 16 Ft. SAND, WATER-BEARING</p>	

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Report 1 - Detailed Well Record

<p>Well Tag Number: 19025</p> <p>Owner: TED OSBORNE</p> <p>Address: CHALET WELL (COLDSTREAM RANCH)</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): 082L025113 Well: 3</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: Dug Diameter: 0.0 inches Well Depth: 15.0 feet Elevation: 0 Bedrock Depth: UNK feet</p>	<p>Construction Date: 1965-01-01 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: 850 (Driller's Estimate) U. Artesian Flow: Static Level: 4 feet</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>Surface Seal Flag: Surface Seal Material: Surface Seal Method: Surface Seal Depth: Surface Seal Thickness:</p> <p>Lithology Info Flag: Pump Test Info Flag: Y File Info Flag: Sieve Info Flag: Screen Info Flag: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM): Site Info Details: Other Info Flag: Other Info Details:</p>
<p>GENERAL REMARKS:</p> <p>From 0 to 0 Ft. NO LOG- THIS WELL CONSISTS OF A CONCRETE From 0 to 0 Ft. SUMP, WITH TWO PERFORATED PIPES.</p>	

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Report 1 - Detailed Well Record

<p>Well Tag Number: 19026</p> <p>Owner: GEOLOGICAL SURVEY</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): 082L025113 Well: 2</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 Well Depth: 200.0 feet Elevation: 0 Bedrock Depth: UNK feet</p>	<p>Construction Date: 1965-01-01 00:00:00.0</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: 0 (Driller's Estimate) Artesian Flow: 0 Static Level: feet</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>Surface Seal Flag: Surface Seal Material: Surface Seal Method: Surface Seal Depth: Surface Seal Thickness:</p> <p>Lithology Info Flag: Pump Test Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag: EMS ID: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM): Site Info Details: Other Info Flag: Other Info Details:</p>
<p>GENERAL REMARKS: SEE GEOL. SURVEY OF CANADA PAPER 67-56, "FLOW CONTROL PROGRAM, COLDSTREAM RANCH WELL, VERNON B.C.". THIS WELL FLOWED AT A LARGE UNCONTROLLED RATE.U</p> <p>From 140 to 160 Ft. COARSE TO FINE GRAVEL AND SAND (AQUIFER#1) From 160 to 200 Ft. SANDY GLACIAL TILL From 200 to 0 Ft. COARSE GRAVEL (AQUIFER #2) From 60 to 140 Ft. STRATIFIED SILT AND CLAY From 0 to 60 Ft. FINE MED. SAND</p>	

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Report 1 - Detailed Well Record

<p>Well Tag Number: 21279</p> <p>Owner: NORM WADE</p> <p>Address:</p> <p>Area: LAVINGTON</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): 082L025142 Well: 2</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 Well Depth: 100.0 feet Elevation: 0 Bedrock Depth: UNK feet</p>	<p>Construction Date: 1968-01-28 00:00:00.0</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: 250 (Driller's Estimate) Ga Artesian Flow: Static Level: 52 feet</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>Surface Seal Flag: Surface Seal Material: Surface Seal Method: Surface Seal Depth: Surface Seal Thickness:</p> <p>Lithology Info Flag: Pump Test Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM): Site Info Details: Other Info Flag: Other Info Details:</p>
<p>GENERAL REMARKS:</p> <p>From 0 to 51 Ft. TILL From 51 to 100 Ft. GRAVEL, WATER-BEARING</p>	

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Report 1 - Detailed Well Record

<p>Well Tag Number: 23041</p> <p>Owner: TED STREIBEL</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): 082L025123 Well: 11</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 Well Depth: 202.0 feet Elevation: 0 Bedrock Depth: UNK feet</p>	<p>Construction Date: 1969-12-04 00:00:00.0</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: 100 (Driller's Estimate) C Artesian Flow: 0 Static Level: 10 feet</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>Surface Seal Flag: Surface Seal Material: Surface Seal Method: Surface Seal Depth: Surface Seal Thickness:</p> <p>Lithology Info Flag: Pump Test Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM): Site Info Details: Other Info Flag: Other Info Details:</p>
<p>GENERAL REMARKS:</p> <p>From 0 to 110 Ft. CLAY, HARD From 110 to 194 Ft. SILTY CLAY From 194 to 202 Ft. SAND & GRAVEL</p>	

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Report 1 - Detailed Well Record

<p>Well Tag Number: 26612</p> <p>Owner: M DEIS</p> <p>Address: PARK LANE RD</p> <p>Area: LAVINGTON</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): 082L025231 Well: 2</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 Well Depth: 92.0 feet Elevation: 0 Bedrock Depth: UNK feet</p>	<p>Construction Date: 1972-07-13 00:00:00.0</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: 15 (Driller's Estimate) Ga Artesian Flow: Static Level: 40 feet</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>Surface Seal Flag: Surface Seal Material: Surface Seal Method: Surface Seal Depth: Surface Seal Thickness:</p> <p>Lithology Info Flag: Pump Test Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM): Site Info Details: Other Info Flag: Other Info Details:</p>
<p>GENERAL REMARKS:</p> <p>From 0 to 40 Ft. DRY SAND From 40 to 85 Ft. FINE SILTY SAND WATER-BEARING From 85 to 92 Ft. GRAVEL SILTY WATER-BEARING</p>	

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Report 1 - Detailed Well Record

<p>Well Tag Number: 29589</p> <p>Owner: NORM WADE</p> <p>Address:</p> <p>Area: LAVINGTON</p> <p>WELL LOCATION: OSOYOOS (ODYD) Land District District Lot: Plan: Lot: Township: 6 Section: 23Range: Indian Reserve: Meridian: Block: Quarter: Island BCGS Number (NAD 27): 082L025142 Well: 5</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 Well Depth: 155.0 feet Elevation: 0 Bedrock Depth: UNK feet</p>	<p>Construction Date: 1974-01-01 00:00:00.0</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: 239 (Driller's Estimate) Ga Artesian Flow: Static Level: 72 feet</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>Surface Seal Flag: Surface Seal Material: Surface Seal Method: Surface Seal Depth: Surface Seal Thickness:</p> <p>Lithology Info Flag: Pump Test Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM): Site Info Details: Other Info Flag: Other Info Details:</p>
<p>GENERAL REMARKS:</p> <p>From 0 to 65 Ft. DRY GRAVEL From 65 to 70 Ft. WATER-BEARING From 70 to 90 Ft. TILL From 90 to 100 Ft. SILTY SAND From 100 to 145 Ft. TILL From 145 to 155 Ft. WATER-BEARING GRAVEL</p>	

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Report 1 - Detailed Well Record

<p>Well Tag Number: 30996</p> <p>Owner: IVAN PODGORNIK</p> <p>Address: ON COLDSTREAM RANCH LAND</p> <p>Area: VERNON</p> <p>WELL LOCATION: OSOYOOS (ODYD) Land District District Lot: 225 Plan: 1216 Lot: Township: 6 Section: 20 Range: Indian Reserve: Meridian: Block: Quarter: Island BCGS Number (NAD 27): 082L025132 Well: 2</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: Unknown Constr Diameter: 0.0 inches Well Depth: 166.0 feet Elevation: 0 Bedrock Depth: UNK feet</p>	<p>Construction Date: 1974-08-12 00:00:00.0</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: 1.5 (Driller's Estimate) Ga Artesian Flow: Static Level: feet</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>Surface Seal Flag: Surface Seal Material: Surface Seal Method: Surface Seal Depth: Surface Seal Thickness:</p> <p>Lithology Info Flag: Pump Test Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM): Site Info Details: Other Info Flag: Other Info Details:</p>
<p>GENERAL REMARKS:</p> <p>From 0 to 8 Ft. ROCK, GRAVEL & CLAY From 8 to 22 Ft. SURFACE GRAVEL WITH WATER From 22 to 48 Ft. TILL, ROCK, GRAVEL & SOME GRAY CLAY From 48 to 122 Ft. LOOSE TILL, SOMEWHAT FREE OF CLAY, WATER From 122 to 154 Ft. TILL, ROCK, GRAVEL & GRAYISH BLUE CLAY From 154 to 166 Ft. GRAVEL & SAND, DRILLED VERY SLOW. ELECTRIC From 0 to 0 Ft. LOG READ WATER.</p>	

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Report 1 - Detailed Well Record

<p>Well Tag Number: 33679</p> <p>Owner: ED WEIST</p> <p>Address:</p> <p>Area: VERNON</p> <p>WELL LOCATION: OSOYOOS (ODYD) Land District District Lot: Plan: 134530 Lot: Township: 6 Section: 22 Range: Indian Reserve: Meridian: Block: Quarter: NE Island BCGS Number (NAD 27): 082L025141 Well: 1</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: Unknown Constru Diameter: 6.0 inches Well Depth: 170.0 feet Elevation: 0 Bedrock Depth: UNK feet</p>	<p>Construction Date: 1975-10-14 00:00:00.0</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: 0 (Driller's Estimate) Artesian Flow: Static Level: feet</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>Surface Seal Flag: Surface Seal Material: Surface Seal Method: Surface Seal Depth: Surface Seal Thickness:</p> <p>Lithology Info Flag: Pump Test Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM): Site Info Details: Other Info Flag: Other Info Details:</p>
<p>GENERAL REMARKS: DRY HOLE</p> <p>From 0 to 10 Ft. BROWN CLAY WITH GRAVEL From 10 to 48 Ft. CLAYISH SILTY SAND & GRAVEL, DRY From 48 to 54 Ft. SILTY GRAY CLAY From 54 to 93 Ft. GRAY CLAY From 93 to 124 Ft. SILTY GRAY CLAY WITH BANDS OF BROWN CLAY From 124 to 170 Ft. BLACKISH & BROWN CLAY, VERY HARD & SORT From 0 to 0 Ft. OF BANDED.</p>	

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Report 1 - Detailed Well Record

<p>Well Tag Number: 39359</p> <p>Owner: PAUL DUMONT</p> <p>Address: OUT HWY 6 FROM VERNON</p> <p>Area: LAVINGTON</p> <p>WELL LOCATION: OSOYOOS (ODYD) Land District District Lot: Plan: Lot: Township: 6 Section: 15Range: Indian Reserve: Meridian: Block: Quarter: NE Island BCGS Number (NAD 27): 082L025123 Well: 14</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: Unknown Constru Diameter: 5.5 inches Well Depth: 220.0 feet Elevation: 0 Bedrock Depth: UNK feet</p>	<p>Construction Date: 1978-03-07 00:00:00.0</p> <p>Driller: Stewart Drilling Well Identification Plate Number: Plate Attached By: Where Plate Attached:</p> <p>PRODUCTION DATA AT TIME OF DRILLING: Well Yield: 100 (Driller's Estimate) C Artesian Flow: Static Level: feet</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>Surface Seal Flag: Surface Seal Material: Surface Seal Method: Surface Seal Depth: Surface Seal Thickness:</p> <p>Lithology Info Flag: Pump Test Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM): Site Info Details: Other Info Flag: Other Info Details:</p>
<p>GENERAL REMARKS:</p> <p>From 0 to 0 Ft. NO LOG- DEEPENED WELL FROM 180'-220'</p> <p>From 0 to 0 Ft. COULD NOT FIND ORIGINAL WELL CARD.</p>	

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Report 1 - Detailed Well Record

<p>Well Tag Number: 43926</p> <p>Owner: HARRY OLAFSON</p> <p>Address: HWY 6</p> <p>Area: LAVINGTON</p> <p>WELL LOCATION: OSOYOOS (ODYD) Land District District Lot: Plan: 21329 Lot: 1 Township: 6 Section: 23 Range: Indian Reserve: Meridian: Block: Quarter: NW Island BCGS Number (NAD 27): 082L025123 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 Well Depth: 50.0 feet Elevation: 0 Bedrock Depth: UNK feet</p>	<p>Construction Date: 1979-12-01 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: 15 (Driller's Estimate) (C Artesian Flow: Static Level: 11 feet</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>Surface Seal Flag: Surface Seal Material: Surface Seal Method: Surface Seal Depth: Surface Seal Thickness:</p> <p>Lithology Info Flag: Pump Test Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM): Site Info Details: Other Info Flag: Other Info Details:</p>
<p>GENERAL REMARKS:</p> <p>From 0 to 15 Ft. TOPSOIL & LARGE ROCKS From 15 to 18 Ft. WATER-BEARING SAND From 18 to 38 Ft. HARDPAN From 38 to 50 Ft. CLAY</p>	

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Report 1 - Detailed Well Record

<p>Well Tag Number: 43927</p> <p>Owner: HARRY OLAFSON</p> <p>Address: HWY 6</p> <p>Area: LAVINGTON</p> <p>WELL LOCATION: OSOYOOS (ODYD) Land District District Lot: Plan: 21329 Lot: 1 Township: 6 Section: 23 Range: Indian Reserve: Meridian: Block: Quarter: NW Island BCGS Number (NAD 27): 082L025123 Well: 12</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: 8.0 inches Well Depth: 155.0 feet Elevation: 0 Bedrock Depth: UNK feet</p>	<p>Construction Date: 1979-12-01 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: 15 (Driller's Estimate) G Artesian Flow: Static Level: 8 feet</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>Surface Seal Flag: Surface Seal Material: Surface Seal Method: Surface Seal Depth: Surface Seal Thickness:</p> <p>Lithology Info Flag: Pump Test Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM): Site Info Details: Other Info Flag: Other Info Details:</p>
<p>GENERAL REMARKS:</p> <p>From 0 to 11 Ft. TOPSOIL, CLAY & ROCKS From 1 to 32 Ft. WATER-BEARING SAND LAYERS From 32 to 50 Ft. CLAY & SILT LAYERS From 50 to 155 Ft. CLAY From 155 to 0 Ft. SILT</p>	

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Report 1 - Detailed Well Record

<p>Well Tag Number: 44255</p> <p>Owner: DUSTY MILLER</p> <p>Address: BUCHANAN RD</p> <p>Area: COLDSTREAM</p> <p>WELL LOCATION: OSOYOOS (ODYD) Land District District Lot: Plan: 1216 Lot: 239 Township: 6 Section: 20 Range: Indian Reserve: Meridian: Block: Quarter: Island BCGS Number (NAD 27): 082L025133 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: Drilled Diameter: 6.0 inches Well Depth: 40.0 feet Elevation: 0 Bedrock Depth: UNK feet</p>	<p>Construction Date: 1980-01-01 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: 4 (Driller's Estimate) G Artesian Flow: Static Level: feet</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>Surface Seal Flag: Surface Seal Material: Surface Seal Method: Surface Seal Depth: Surface Seal Thickness:</p> <p>Lithology Info Flag: Pump Test Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag: EMS ID: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM): Site Info Details: Other Info Flag: Other Info Details:</p>
<p>GENERAL REMARKS:</p> <p>From 0 to 2 Ft. TOPSOIL From 2 to 20 Ft. LOOSE ROCKS & GRAVEL From 20 to 34 Ft. CLAY From 34 to 40 Ft. WATER-BEARING GRAVEL</p>	

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Report 1 - Detailed Well Record

<p>Well Tag Number: 46266</p> <p>Owner: W K DOBSON</p> <p>Address: BUCHANAN RD</p> <p>Area: COLDSTREAM</p> <p>WELL LOCATION: OSOYOOS (ODYD) Land District District Lot: Plan: 1216 Lot: 232 Township: Section: 20 Range: Indian Reserve: Meridian: Block: Quarter: Island BCGS Number (NAD 27): 082L025132 Well: 1</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: Unknown Constr Diameter: 7.0 inches Well Depth: 360.0 feet Elevation: 0 Bedrock Depth: 130 feet</p>	<p>Construction Date: 1980-10-01 00:00:00.0</p> <p>Driller: McHarg Drilling Well Identification Plate Number: Plate Attached By: Where Plate Attached:</p> <p>PRODUCTION DATA AT TIME OF DRILLING: Well Yield: 3 (Driller's Estimate) G Artesian Flow: Static Level: 10 feet</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>Surface Seal Flag: Surface Seal Material: Surface Seal Method: Surface Seal Depth: Surface Seal Thickness:</p> <p>Lithology Info Flag: Pump Test Info Flag: Y File Info Flag: Sieve Info Flag: Screen Info Flag: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM): Site Info Details: Other Info Flag: Other Info Details:</p>
<p>GENERAL REMARKS:</p> <p>From 0 to 160 Ft. OVERBURDEN From 160 to 360 Ft. BEDROCK From 0 to 0 Ft. WATER-BEARING FRACTURES AT 300'.</p>	

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Report 1 - Detailed Well Record

<p>Well Tag Number: 46619</p> <p>Owner: DEPT OF ENERGY MINES</p> <p>Address: COLDSTREAM RANCH</p> <p>Area: VERNON</p> <p>WELL LOCATION: OSOYOOS (ODYD) Land District District Lot: 57 Plan: B1299 Lot: B Township: Section: Range: Indian Reserve: Meridian: Block: Quarter: Island BCGS Number (NAD 27): 082L025113 Well: 8</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: 16.0 inches Well Depth: 175.0 feet Elevation: 0 Bedrock Depth: UNK feet</p>	<p>Construction Date: 1980-11-14 00:00:00.0</p> <p>Driller: Quality Well Drilling Well Identification Plate Number: Plate Attached By: Where Plate Attached:</p> <p>PRODUCTION DATA AT TIME OF DRILLING: Well Yield: 0 (Driller's Estimate) Artesian Flow: 0 Static Level: 4 feet</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>Surface Seal Flag: Surface Seal Material: Surface Seal Method: Surface Seal Depth: Surface Seal Thickness:</p> <p>Lithology Info Flag: Pump Test Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM): Site Info Details: Other Info Flag: Other Info Details:</p>
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GENERAL REMARKS:

From	4 to	159 Ft.	30" SURFACE CASING
From	159 to	161 Ft.	GRAY SAND & ROUND PEBBLE MEDIUM
From	161 to	162 Ft.	GRAY SAND & SMALL GRAVEL DIRTY & TIGHT
From	162 to	164 Ft.	GRAY SAND MEDIUM & SMALL GRAVEL TIGHT
From	164 to	166 Ft.	GRAY TIGHT SAND WITH LOTS OF FINES WITH
From	0 to	0 Ft.	SOME GRAVEL.
From	166 to	167.5 Ft.	VERY TIGHT CEMENTED SAND & GRAVEL & CLAY
From	167.5 to	171 Ft.	POLISHED PEBBLES & PEAS MEDIUM LARGE
From	0 to	0 Ft.	GRAVEL, CLEAN WITH MORE WATER PRESSURE
From	171 to	173 Ft.	GRAY SAND CLEAN WITH LOTS OF FINES,
From	0 to	0 Ft.	PEBBLES & PEAS & DIRTY.
From	173 to	174.5 Ft.	SMALL GRAVEL & PEAS & COARSE SAND
From	174.5 to	175 Ft.	CEMENTED SAND & GRAVEL, TIGHT & SHARP
From	0 to	0 Ft.	WITH HARDPAN.



Report 1 - Detailed Well Record

Well Tag Number: 47818	Construction Date: 1981-05-01 00:00:00.
Owner: VERNON IRRIG. DIST.	Driller: Quality Well Drilling
Address: COLDSTREAM RANCH	Well Identification Plate Number:
Area: COLDSTREAM	Plate Attached By:
WELL LOCATION:	Where Plate Attached:
OSOYOOS (ODYD) Land District	PRODUCTION DATA AT TIME OF DRILLING:
District Lot: 57 Plan: 29697 Lot: A	Well Yield: 1200 (Driller's Estimate)
Township: Section: Range:	Artesian Flow: 0
Indian Reserve: Meridian: Block:	Static Level: 2 feet
Quarter:	Water Utility:
Island	Water Supply System Name:
BCGS Number (NAD 27): 082L025113 Well: 7	Water Supply System Well Name:
Class of Well:	Surface Seal Flag:
Subclass of Well:	Surface Seal Material:
Orientation of WELL:	Surface Seal Method:
Status of Well: New	Surface Seal Depth: 0
Well Use: Irrigation	Surface Seal Thickness:
Observation Well Number:	Lithology Info Flag:
Observation Well Status:	Pump Test Info Flag: Y
Construction Method: Drilled	File Info Flag:
Diameter: 16.0 inches	Sieve Info Flag:
Well Depth: 175.0 feet	Screen Info Flag:
Elevation: 0	Water Chemistry Info Flag: Y
Bedrock Depth: UNK feet	Field Chemistry Info Flag:
Screen from 0 to 0 feet Slot Size 0	Site Info (SEAM):
Screen from 0 to 0 feet Slot Size 0	Site Info Details:
Screen from 0 to 0 feet Slot Size 0	Other Info Flag:
Screen from 0 to 0 feet Slot Size 0	Other Info Details:

GENERAL REMARKS:

INFO IS HELD BY REGIONAL DISTRICT OF NORTH OKANAGAN

From	0 to	2 Ft.	BLACK SANDY SOIL
From	2 to	8 Ft.	BROWN SAND & CLAY
From	8 to	16 Ft.	BROWN CLAY, SEMI HARD
From	16 to	23 Ft.	BROWN SAND FINE WITH CLAY
From	23 to	32 Ft.	COARSER GRAVELL & PEAS WITH SAND
From	32 to	36 Ft.	GRAY SAND & PEBBLES LOTS OF FINES
From	36 to	40 Ft.	GRAY SAND & PEBBLES CLEAN WITH FINES
From	40 to	46 Ft.	CLEAN SAND, COARSER, WITH SMALL PEBBLES'
From	0 to	0 Ft.	PEAS MIXED IN.
From	46 to	52 Ft.	CLEAN BROWN SAND & PEBBLES, 10-15% FINES
From	52 to	57 Ft.	SAND GETTING FINER, CLEAN, SOME PEBBLES
From	57 to	64 Ft.	GRAY SAND, LOTS OF FINES, STREAKS OF GRAY
From	0 to	0 Ft.	CLAY.
From	64 to	66 Ft.	GRAY CLAY, FIRM WITH GRAY SAND, MIXED
From	66 to	76 Ft.	GRAY CLAY, SEMI FIRM, STICKY
From	76 to	88 Ft.	GRAY CLAY, SEMI FIRM

From	88	to	98	Ft.	GRAY CLAY
From	98	to	108	Ft.	GRAY CLAY, STICKY
From	108	to	125	Ft.	GRAY CLAY
From	125	to	141	Ft.	GRAY CLAY, SOFT
From	141	to	144.5	Ft.	GRAY SAND, FIRM, DRY
From	144.5	to	148	Ft.	SHARP GRAVEL, LARGE & SMALL, & WET GRAY--
From	0	to	0	Ft.	SAND.
From	148	to	150	Ft.	GRAY SAND & GRAVEL, TIGHT & DIRTY
From	150	to	152.5	Ft.	GRAY SAND, FIRM, LITTLE DIRTY, TIGHT
From	152.5	to	154	Ft.	SMALL & LARGE GRAVEL WITH GRAY SAND, LOTS
From	0	to	0	Ft.	OF FINES.
From	154	to	156	Ft.	TIGHT SAND & GRAVEL WITH BIG COBBLES,
From	0	to	0	Ft.	LOTS OF FINES.
From	156	to	160	Ft.	GRAY SAND & PEBBLES & SMALL GRAVEL, --
From	0	to	0	Ft.	15-20% FINES.
From	160	to	162	Ft.	SMALL PEBBLES & GRAY SAND, LOOSE, VERY
From	0	to	0	Ft.	SMALL GRAVEL MIXED IN.
From	162	to	164	Ft.	GRAY SAND & PEBBLES. LOTS OF FINES
From	164	to	165	Ft.	CEMENTED SAND & GRAVEL
From	165	to	173	Ft.	HARD CEMENTED SAND & GRAVEL
From	173	to	175	Ft.	GRAY CEMENTED SAND & GRAVEL

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Report 1 - Detailed Well Record

<p>Well Tag Number: 48118</p> <p>Owner: FRANK TISCHIK</p> <p>Address: SCHOOL RD</p> <p>Area: LAVINGTON</p> <p>WELL LOCATION: OSOYOOS (ODYD) Land District District Lot: Plan: 18721 Lot: 2 Township: 6 Section: 23 Range: Indian Reserve: Meridian: Block: Quarter: Island BCGS Number (NAD 27): 082L025142 Well: 4</p> <p>Class of Well: Subclass of Well: Orientation of Well: Status of Well: New Well Use: Irrigation Observation Well Number: Observation Well Status: Construction Method: Drilled Diameter: 12.0 inches Well Depth: 210.0 feet Elevation: 0 Bedrock Depth: UNK feet</p>	<p>Construction Date: 1981-06-01 00:00:00.0</p> <p>Driller: Quality Well Drilling Well Identification Plate Number: Plate Attached By: Where Plate Attached:</p> <p>PRODUCTION DATA AT TIME OF DRILLING: Well Yield: 0 (Driller's Estimate) Artesian Flow: Static Level: 9 feet</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>Surface Seal Flag: Surface Seal Material: Surface Seal Method: Surface Seal Depth: Surface Seal Thickness:</p> <p>Lithology Info Flag: Pump Test Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM): Site Info Details: Other Info Flag: Other Info Details:</p>
<p>GENERAL REMARKS:</p> <p>From 0 to 2 Ft. BLACK TOPSOIL</p> <p>From 2 to 60 Ft. SOFT GRAY CLAY WITH ROTTEN VEGETATION</p> <p>From 60 to 80 Ft. HARD GRAY CLAY</p> <p>From 80 to 110 Ft. GRAY CLAY SOFT</p> <p>From 110 to 111 Ft. GRAY SILTY SAND PASTY</p> <p>From 111 to 113 Ft. BIG ROCKS & FINE GRAY SAND</p> <p>From 113 to 160 Ft. GRAY CLAY SOFT WITH SAND STREAKS</p> <p>From 160 to 175 Ft. HARD GRAY CLAY</p> <p>From 175 to 180 Ft. SOFT GRAY CLAY</p> <p>From 180 to 182 Ft. GRAY SAND & PEBBLES & SHARP ROCKS</p> <p>From 182 to 185 Ft. GRAYISH SAND CLEAN WITH PEBBLES</p> <p>From 185 to 187 Ft. CLEAN PEBBLES, PEAS & SAND</p> <p>From 187 to 189 Ft. COARSER SAND, GRAVEL & PEBBLES & PEAS</p> <p>From 0 to 0 Ft. CLEAN, FEW FINES.</p> <p>From 189 to 210 Ft. CLEAN COARSE SAND POLISHED PEBBLES &</p> <p>From 0 to 0 Ft. PEAS, SMALL GRAVEL.</p>	



Report 1 - Detailed Well Record

<p>Well Tag Number: 49912</p> <p>Owner: VERNON IRRIGATION DI</p> <p>Address:</p> <p>Area:</p> <p>WELL LOCATION: OSOYOOS (ODYD) Land District District Lot: 57 Plan: 29697 Lot: A Township: 6 Section: 17 Range: Indian Reserve: Meridian: Block: Quarter: Island BCGS Number (NAD 27): 082L025113 Well: 5</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 Well Depth: 176.0 feet Elevation: 0 Bedrock Depth: UNK feet</p>	<p>Construction Date: 1982-02-01 00:00:00.0</p> <p>Driller: Quality Well Drilling Well Identification Plate Number: Plate Attached By: Where Plate Attached:</p> <p>PRODUCTION DATA AT TIME OF DRILLING: Well Yield: 0 (Driller's Estimate) Artesian Flow: Static Level: 20 feet</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>Surface Seal Flag: Surface Seal Material: Surface Seal Method: Surface Seal Depth: Surface Seal Thickness:</p> <p>Lithology Info Flag: Pump Test Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM): Site Info Details: Other Info Flag: Other Info Details:</p>
<p>GENERAL REMARKS:</p> <p>From 0 to 2 Ft. BLACK SANDY SOIL</p> <p>From 2 to 12 Ft. BROWN SAND & GRAVEL, SOME ROCKS HAD BROWN</p> <p>From 0 to 0 Ft. CLAY STUCK TO THEM.</p> <p>From 12 to 18 Ft. LOOSE SAND & GRAVEL, CLEAN</p> <p>From 18 to 24 Ft. BROWN SAND & POLISHED GRAVEL, CLEAN</p> <p>From 24 to 30 Ft. LARGE & SMALL GRAVEL, SMALL PEBBLES</p> <p>From 0 to 0 Ft. & PEAS WITH COARSE CLEAN SAND.</p> <p>From 30 to 37 Ft. SMALL GRAVEL & LITTLE SAND, CLEAN, ACTIVE,</p> <p>From 0 to 0 Ft. SMALL PEBBLES.</p> <p>From 37 to 43 Ft. BROWN SAND, FINE, SOME ROCKS</p> <p>From 43 to 50 Ft. BROWN SAND FINE, SMALL GRAVEL MIXED IN,</p> <p>From 0 to 0 Ft. LITTLE DIRTY.</p> <p>From 50 to 53 Ft. BROWN SAND & SAMLL GRAVEL DIRTY, MAKING</p> <p>From 0 to 0 Ft. WATER.</p> <p>From 53 to 60 Ft. SMALL GRAVEL & BROWN SAND, SOME FINES</p> <p>From 60 to 66 Ft. CLEAN BROWN SAND, COARSE WITH SAMLL TO</p>	

From	0	to	0	Ft.	MEDIUM GRAVEL MIXED IN, VERY ACTIVE.
From	66	to	70	Ft.	BROWN CLAY
From	70	to	80	Ft.	BROWN SAND CLEAN WITH LOTS OF FINES, SOME
From	0	to	0	Ft.	SMALL PEBBLES.
From	80	to	85	Ft.	SAND BROWN FINE, GETTING DIRTY
From	85	to	90	Ft.	GRAY CLAY MEDIUM TO HARD
From	90	to	100	Ft.	SOFT GRAY CLAY
From	100	to	110	Ft.	GRAY CLAY MEDIUM TO SOFT
From	110	to	125	Ft.	SOFT GRAY CLAY WITH SAND STREAKS
From	125	to	132	Ft.	HARD CLAY, SANDY
From	132	to	137	Ft.	HARD DRY SAND WITH ROCK
From	137	to	150	Ft.	HARD GRAY CLAY
From	150	to	165	Ft.	HARD GRAY CLAY SOME ROCKS & STREAKS OF
From	0	to	0	Ft.	SAND.
From	165	to	167	Ft.	LOOSE PEBBLES & PEAS LARGE & SMALL --
From	0	to	0	Ft.	GRAVEL, POLISHED, WATER-BEARING, SOME GRAY
From	0	to	0	Ft.	SAND.
From	167	to	169	Ft.	COARSE PEBBLES & PEAS WITH SMALL GRAVEL,
From	0	to	0	Ft.	LOOSE, SOME GRAY SAND.
From	169	to	176	Ft.	TIGHT CEMENTED SAND WITH ROCKS & GRAY -
From	0	to	0	Ft.	CLAY, VERY HARD.

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Report 1 - Detailed Well Record

<p>Well Tag Number: 49978</p> <p>Owner: VERNON IRRIGATION DI</p> <p>Address: SOUTH EAST CORNER OF RANCH</p> <p>Area:</p> <p>WELL LOCATION: OSOYOOS (ODYD) Land District District Lot: 57 Plan: 29697 Lot: A Township: 6 Section: 17 Range: Indian Reserve: Meridian: Block: Quarter: Island BCGS Number (NAD 27): 082L025113 Well: 4</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 Well Depth: 209.0 feet Elevation: 0 Bedrock Depth: UNK feet</p>	<p>Construction Date: 1982-03-01 00:00:00.0</p> <p>Driller: Quality Well Drilling Well Identification Plate Number: Plate Attached By: Where Plate Attached:</p> <p>PRODUCTION DATA AT TIME OF DRILLING: Well Yield: 0 (Driller's Estimate) Artesian Flow: Static Level: 20 feet</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>Surface Seal Flag: Surface Seal Material: Surface Seal Method: Surface Seal Depth: Surface Seal Thickness:</p> <p>Lithology Info Flag: Pump Test Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM): Site Info Details: Other Info Flag: Other Info Details:</p>
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GENERAL REMARKS:

TEST HOLE #1

From	0 to	2 Ft.	BLACK SOIL
From	2 to	14 Ft.	BROWN SAND & GRAVEL WITH BROWN CLAY &
From	0 to	0 Ft.	ROCKS.
From	14 to	21 Ft.	LARGE & SMALL GRAVEL WITH SHARP ROCKS
From	0 to	0 Ft.	TIGHT BROWN SAND.
From	21 to	33 Ft.	TIGHT SAND & GRAVEL, COMPACT WITH BROWN
From	0 to	0 Ft.	CLAY. HARD DRILLING.
From	33 to	43 Ft.	SAND & GRAVEL BROWN WITH STRIPS OF BROWN
From	0 to	0 Ft.	CLAY & ROCK, GETTING LOOSER.
From	43 to	53 Ft.	COARSE SAND & SMALL GRAVEL GETTING --
From	0 to	0 Ft.	CLEANER. CASING MOVING EASIER.
From	53 to	54 Ft.	COARSE CLEAN SAND WITH SMALL GRAVEL, --
From	0 to	0 Ft.	ACTIVE & GOOD.
From	54 to	56 Ft.	COARSER SAND WITH SMALL PEBBLES, ACTIVE
From	0 to	0 Ft.	CLEAN.
From	56 to	58 Ft.	BROWN SAND LOTS OF FINES, SMALL SHARP

From	0	to	0	Ft.	GRAVEL MIXED IN.
From	58	to	60	Ft.	BROWN SAND, FINER WITH SOME PEBBLES, WATER
From	0	to	0	Ft.	LITTLE DIRTIER.
From	60	to	61.5	Ft.	BROWN SAND WITH SOME PEBBLES, FINER, WATER
From	0	to	0	Ft.	GETTING DIRTIER.
From	61.5	to	63	Ft.	GRAY CLAY, SEMI SOFT
From	63	to	69	Ft.	GRAY SAND & PEBBLES MIXED WITH GRAY CLAY
From	69	to	72	Ft.	BROWN SAND & SMALL PEBBLES WITH BROWN --
From	0	to	0	Ft.	STREAKS OF CLAY, DIRTY.
From	72	to	74	Ft.	DIRTY BROWN SAND & SAMLL GRAVEL, SHARP
From	0	to	0	Ft.	WITH CLAY STREAKS BROWN.
From	74	to	76	Ft.	CEMENTED SAND & GRAVEL, TIGHT DRILLED
From	76	to	80	Ft.	TIGHT SAND & GRAVEL, SHARP
From	80	to	84	Ft.	LOOSE BROWN SAND, MEDIUM TO SAMLL GRAVEL
From	0	to	0	Ft.	POLISHED, ACTIVE.
From	84	to	86	Ft.	BROWN SAND, VERY LOOSE, WITH MEDIUM TO --
From	0	to	0	Ft.	SNALL GRAVEL, ACTIVE.
From	86	to	88	Ft.	BROWN SAND GETTING FINER WITH SMALL --
From	0	to	0	Ft.	PEBBLES, SOME FINES.
From	88	to	90	Ft.	BROWN SAND, FINER, CLEANER, WITH SOME SMALL
From	0	to	0	Ft.	PEBBLES, ACTIVE.
From	90	to	96	Ft.	BROWN SAND & PEBBLES WITH BROWN CLAY --
From	0	to	0	Ft.	STREAKS, CLEAN.
From	96	to	100	Ft.	BROWN CLAY
From	100	to	110	Ft.	GRAY CLAY SEMI HARD
From	110	to	121	Ft.	SANDY CLAY, HARD, GRAY IN COLOUR
From	121	to	131	Ft.	MEIUM TO SOFT CLAY, GRAY WITH SOME --
From	0	to	0	Ft.	PEBBLES.
From	131	to	138	Ft.	MEDIUM TO SOFT GRAY CLAY
From	138	to	144	Ft.	GRAY & BLACKISH SAND, VERY HARD, DRY
From	144	to	146	Ft.	GRAY SAND WITH PEBBLES, MAKING WATER, --
From	0	to	0	Ft.	LITTLE DIRTY.
From	146	to	152	Ft.	GRAY SAND, GETTING CLEANER, ACTIVE
From	152	to	161	Ft.	DIRYT GRAY SAND WITH CLAY MIXED IN DIRTY
From	0	to	0	Ft.	WATER, DRILLED.
From	161	to	163	Ft.	CLEAN SAND ACTIVE
From	163	to	187	Ft.	GRAY CLAY SOFT
From	187	to	189	Ft.	BLACKISH GRAY SAND WITH BIG ROCKS, TIGHT
From	189	to	191	Ft.	BLACKISH GRAY SAND GETTING CLEANER WITH
From	0	to	0	Ft.	SMAL GRAVEL, SOME SHARPS MAKING WATER.
From	191	to	193	Ft.	SMALL GRAVEL & SAND. SOME FINES, GRAY CLAY
From	0	to	0	Ft.	STREAKS MIXED IN.
From	193	to	209	Ft.	CEMENTED BLACK SAND WITH GRAY CLAY VERY
From	0	to	0	Ft.	TIGHT, DRILLED, NO TMAKING WATER.

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Report 1 - Detailed Well Record

<p>Well Tag Number: 51248</p> <p>Owner: RICK GRANT</p> <p>Address: HWY 6</p> <p>Area: LAVINGTON</p> <p>WELL LOCATION: OSOYOOS (ODYD) Land District District Lot: Plan: 18721 Lot: 1 Township: 6 Section: 24 Range: Indian Reserve: Meridian: Block: Quarter: Island BCGS Number (NAD 27): 082L025231 Well: 3</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 Well Depth: 196.0 feet Elevation: 0 Bedrock Depth: UNK feet</p>	<p>Construction Date: 1982-10-30 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: 40 (Driller's Estimate) Gpd Artesian Flow: Static Level: 24 feet</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>Surface Seal Flag: Surface Seal Material: Surface Seal Method: Surface Seal Depth: Surface Seal Thickness:</p> <p>Lithology Info Flag: Pump Test Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM): Site Info Details: Other Info Flag: Other Info Details:</p>
<p>GENERAL REMARKS:</p> <p>From 0 to 10 Ft. BROWN SILTY LOAM From 10 to 28 Ft. BROWN CLAY From 28 to 45 Ft. BROWN SILTY CLAY From 45 to 63 Ft. GRAY SILTY CLAY From 63 to 83 Ft. BROWN SILT From 83 to 105 Ft. GRAY SILTY CLAY From 105 to 122 Ft. GRAY SILTY CLAY & STONES From 122 to 124 Ft. CEMENTED GRAVELS From 124 to 138 Ft. GRAY CLAY & ROCKS From 138 to 164 Ft. GRAY CLAY WITH SILT LAYERS From 164 to 183 Ft. GRAY CLAY From 183 to 191 Ft. CEMENTED GRAVEL From 191 to 196 Ft. FINE TO COARSE SAND & GRAVEL</p>	

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Report 1 - Detailed Well Record

Well Tag Number: 51386	Construction Date: 1982-12-09 00:00:00.
Owner: VERNON I.D.	Driller: Quality Well Drilling
Address: COLDSTREAM RANCH	Well Identification Plate Number:
Area: COLDSTREAM	Plate Attached By:
WELL LOCATION:	Where Plate Attached:
OSOYOOS (ODYD) Land District	PRODUCTION DATA AT TIME OF DRILLING:
District Lot: 57 Plan: 29697 Lot: A	Well Yield: 800 (Driller's Estimate)
Township: Section: Range:	Artesian Flow: 0
Indian Reserve: Meridian: Block:	Static Level: 18 feet
Quarter:	Water Utility:
Island	Water Supply System Name:
BCGS Number (NAD 27): 082L025113 Well: 6	Water Supply System Well Name:
Class of Well:	Surface Seal Flag:
Subclass of Well:	Surface Seal Material:
Orientation of WELL:	Surface Seal Method:
Status of Well: New	Surface Seal Depth: 0
Well Use: Community Water Supply	Surface Seal Thickness:
Observation Well Number:	Lithology Info Flag:
Observation Well Status:	Pump Test Info Flag: Y
Construction Method: Drilled	File Info Flag:
Diameter: 20.0 inches	Sieve Info Flag:
Well Depth: 82.0 feet	Screen Info Flag:
Elevation: 0	Water Chemistry Info Flag: Y
Bedrock Depth: UNK feet	Field Chemistry Info Flag:
Screen from 0 to 0 feet Slot Size 0	Site Info (SEAM):
Screen from 0 to 0 feet Slot Size 0	Site Info Details:
Screen from 0 to 0 feet Slot Size 0	Other Info Flag:
Screen from 0 to 0 feet Slot Size 0	Other Info Details:

GENERAL REMARKS:

INFO IS HELD BY REGIONAL DISTRICT OF NORTH OKANAGAN YIELD REPORTED TO BE DOWN TO 60

From	0 to	2 Ft.	BLACK SANDY SOIL
From	2 to	11 Ft.	BROWN SAND & GRAVEL LARGE & SMALL, LITTLE
From	0 to	0 Ft.	CLAY ON ROCKS.
From	11 to	18.5 Ft.	LOOSE SAND & GRAVEL, CASING FELL DOWN
From	18.5 to	28 Ft.	BROWN SAND WITH SMALL PEBBLES & PEAS WIT
From	0 to	0 Ft.	WITH BIG ROCK MIXED IN, 10-15% FINES.
From	28 to	30 Ft.	POLISHED PEBBLES & PEAS, LOOSE SMALL TO
From	0 to	0 Ft.	MEDIUM GRAVEL VERY FINE, LITTLE FINES.
From	30 to	34 Ft.	CLEAN POLISHED PEBBLES & PEAS, LITTLE
From	0 to	0 Ft.	SAND GRAVEL GETTING LOOSER.
From	34 to	36.5 Ft.	MEDIUM TO LARGE GRAVEL POLISHED & SOME
From	0 to	0 Ft.	SHARPS COARSER SAND MIXED IN, PEBBLES &
From	0 to	0 Ft.	PEAS, ACTIVE, CLEAN.
From	36.5 to	37 Ft.	LARGE GRAVEL WITH BROWN SAND, DARK, WATER
From	0 to	0 Ft.	GETTING DARK BROWN.
From	37 to	43 Ft.	BROWN SAND LOTS OF FINES, DIRTY WITH SOME

From	0 to	0 Ft.	ROCKS MIXED IN.
From	43 to	45 Ft.	DIRTY BROWN SAND WITH SOME BROKEN ROCKS
From	45 to	50 Ft.	BROWN SAND GETTING CLEANER WITH SOME
From	0 to	0 Ft.	PEBBLES.
From	50 to	54 Ft.	BROWN SAND WITH SMALL PEBBLES & SOME --
From	0 to	0 Ft.	GRAVEL.
From	54 to	58 Ft.	BROWN SAND GETTING CLEANER WITH SMALL
From	0 to	0 Ft.	PEBBLES, ACTIVE.
From	58 to	61 Ft.	CLEAN BROWN SAND, SOME FINES WITH PEBBLES
From	0 to	0 Ft.	MIXED IN.
From	61 to	65 Ft.	CLEAN BROWN SAND SMALL TO MEDIUM, PEBBLES
From	0 to	0 Ft.	MIXED IN SOME FINES.
From	65 to	68.5 Ft.	BROWN CLAY
From	68.5 to	70 Ft.	BROWN SAND, CLEAN SOME PEBBLES
From	70 to	73.5 Ft.	CLEAN BROWN SAND WITH PEBBLES
From	73.5 to	75 Ft.	BROWN CLAY LENS WITH BROWN SAND & SMALL
From	0 to	0 Ft.	PEBBLES & LITTLE DIRTY.
From	75 to	77 Ft.	CLEAN BROWN SAND LOTS OF FINES IN WATER
From	77 to	81 Ft.	CLEAN BROWN SAND
From	81 to	82 Ft.	BROWN SAND WITH BROWN CLAY, GETTING DIRTY

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Report 1 - Detailed Well Record

<p>Well Tag Number: 58896</p> <p>Owner: J SLIZAK</p> <p>Address: 7219 BREWER RD</p> <p>Area: VERNON</p> <p>WELL LOCATION: OSOYOOS (ODYD) Land District District Lot: Plan: 1439 Lot: 60 Township: 6 Section: 15 Range: Indian Reserve: Meridian: Block: Quarter: Island BCGS Number (NAD 27): 082L025123 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 Well Depth: 200.0 feet Elevation: 0 Bedrock Depth: feet</p>	<p>Construction Date: 1989-06-23 00:00:00.0</p> <p>Driller: All Western 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) (C Artesian Flow: 0 Static Level: 11 feet</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>Surface Seal Flag: Surface Seal Material: Surface Seal Method: Surface Seal Depth: Surface Seal Thickness:</p> <p>Lithology Info Flag: Pump Test Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM): Site Info Details: Other Info Flag: Other Info Details:</p>
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GENERAL REMARKS:

WELL IS NEAR LAVINGTON

From	0 to	8 Ft.	BOULDERS
From	8 to	10 Ft.	GRAY CLAY
From	10 to	48 Ft.	CEMENTED GRAVEL
From	48 to	181 Ft.	GLACIAL TILL
From	181 to	182 Ft.	GRAVEL
From	182 to	193 Ft.	GLACIAL TILL
From	193 to	200 Ft.	GRAVEL

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Report 1 - Detailed Well Record

<p>Well Tag Number: 62339</p> <p>Owner: I PODCORNIK</p> <p>Address: 7649 BUCHANAN ROAD, SEC 20/21</p> <p>Area: VERNON</p> <p>WELL LOCATION: OSOYOOS (ODYD) Land District District Lot: Plan: 1216 Lot: 225 Township: 6 Section: 20 Range: Indian Reserve: Meridian: Block: Quarter: Island BCGS Number (NAD 27): 082L025132 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: 6.0 inches Well Depth: 51.0 feet Elevation: 0 Bedrock Depth: feet</p>	<p>Construction Date: 1990-09-05 00:00:00.0</p> <p>Driller: All Western Drilling Well Identification Plate Number: Plate Attached By: Where Plate Attached:</p> <p>PRODUCTION DATA AT TIME OF DRILLING: Well Yield: 50 (Driller's Estimate) Ga Artesian Flow: 0 Static Level: 13 feet</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>Surface Seal Flag: Surface Seal Material: Surface Seal Method: Surface Seal Depth: Surface Seal Thickness:</p> <p>Lithology Info Flag: Pump Test Info Flag: Y File Info Flag: Sieve Info Flag: Screen Info Flag: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM): Site Info Details: Other Info Flag: Other Info Details:</p>
<p>GENERAL REMARKS:</p> <p>From 0 to 22 Ft. Gravelly overburdon From 22 to 26 Ft. Grey & silt From 26 to 29 Ft. Coarse gravel From 29 to 34 Ft. Fine sand & silt From 34 to 35 Ft. Coarse gravel, silt From 35 to 43 Ft. Fine sand - silt From 43 to 51 Ft. Coarse & fine sand</p>	

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Report 1 - Detailed Well Record

<p>Well Tag Number: 62341</p> <p>Owner: JERRY SCHWARTZ</p> <p>Address: HILL DRIVE</p> <p>Area: LAVINGTON</p> <p>WELL LOCATION: OSOYOOS (ODYD) Land District District Lot: 12 Plan: 548 Lot: 54 Township: 6 Section: 24 Range: Indian Reserve: Meridian: Block: Quarter: Island BCGS Number (NAD 27): 082L025221 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: Drilled Diameter: 4.3 inches Well Depth: 160.0 feet Elevation: 0 Bedrock Depth: 7 feet</p>	<p>Construction Date: 1973-08-24 00:00:00.0</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: 20 (Driller's Estimate) Gpd Artesian Flow: 0 Static Level: 38 feet</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>Surface Seal Flag: Surface Seal Material: Surface Seal Method: Surface Seal Depth: Surface Seal Thickness:</p> <p>Lithology Info Flag: Pump Test Info Flag: Y File Info Flag: Sieve Info Flag: Screen Info Flag: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM): Site Info Details: Other Info Flag: Other Info Details:</p>
<p>GENERAL REMARKS:</p> <p>From 0 to 10 Ft. Brown clay w/ gravel & rocks From 10 to 25 Ft. Rocks & gravel (dry) From 25 to 34 Ft. Grey clay From 34 to 40 Ft. Rocks in grey clay From 40 to 60 Ft. Gravel in fine mica silty sand. This From 0 to 0 Ft. was cased & tested. It yielded a From 0 to 0 Ft. little over 1.5 GPM From 60 to 114 Ft. Till-rock & gravel in hard grey clay From 114 to 136 Ft. Big rocks in hard grey clay. Very rough From 0 to 0 Ft. drilling From 136 to 153 Ft. Clean gravel & sand From 153 to 160 Ft. Bedrock</p>	

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Report 1 - Detailed Well Record

<p>Well Tag Number: 62739</p> <p>Owner: TOM SIRR</p> <p>Address: RR #1 VERNON</p> <p>Area: BC</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): 082L025124 Well: 3</p> <p>Class of Well: Subclass of Well: Orientation of WELL: Status of Well: New Well Use: Observation Well Number: Observation Well Status: Construction Method: Other Diameter: 0.0 inches Well Depth: 127.0 feet Elevation: 0 Bedrock Depth: feet</p>	<p>Construction Date:</p> <p>Driller: Well Identification Plate Number: Plate Attached By: Where Plate Attached:</p> <p>PRODUCTION DATA AT TIME OF DRILLING: Well Yield: 40 (Driller's Estimate) G Artesian Flow: 0 Static Level: feet</p> <p>Water Utility: Water Supply System Name: Water Supply System Well Name:</p> <p>Surface Seal Flag: Surface Seal Material: Surface Seal Method: Surface Seal Depth: Surface Seal Thickness:</p> <p>Lithology Info Flag: Pump Test Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM): Site Info Details: Other Info Flag: Other Info Details:</p>
<p>GENERAL REMARKS:</p> <p>From 0 to 110 Ft. TILL From 110 to 118 Ft. FINE SAND From 118 to 122 Ft. TILL From 122 to 126 Ft. GRAVEL From 126 to 127 Ft. TILL</p>	

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Information Disclaimer

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Report 1 - Detailed Well Record

<p>Well Tag Number: 62856</p> <p>Owner: MANTON</p> <p>Address: 6652 LEARMOUTH ROAD</p> <p>Area: OSOYOOS</p> <p>WELL LOCATION: OSOYOOS (ODYD) Land District District Lot: Plan: 38750 Lot: 1 Township: 6 Section: 23 Range: Indian Reserve: Meridian: Block: Quarter: Island BCGS Number (NAD 27): 082L025124 Well: 1</p> <p>Class of Well: Water Supply Subclass of Well: Domestic Orientation of WELL: Status of Well: New Well Use: Domestic Observation Well Number: Observation Well Status: Construction Method: Drilled Diameter: 6 inches Well Depth: 115 feet Elevation: 0 Bedrock Depth: feet Screen from 109 to 111 feet Slot Size 0 Screen from 111 to 115 feet Slot Size 80</p>	<p>Construction Date: 1993-05-14 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) Artesian Flow: Static Level: feet</p> <p>Water Utility: N Water Supply System Name: Water Supply System Well Name:</p> <p>Surface Seal Flag: N Surface Seal Material: Surface Seal Method: Surface Seal Depth: Surface Seal Thickness:</p> <p>Lithology Info Flag: Y Pump Test Info Flag: Y File Info Flag: Y Sieve Info Flag: N Screen Info Flag: Y EMS ID: Water Chemistry Info Flag: N Field Chemistry Info Flag: Site Info (SEAM): N Site Info Details: Other Info Flag: Other Info Details:</p>
<p>GENERAL REMARKS: WELDED CAP; BACKFILLED W/SAND & CLAY</p> <p>From 0 to 31 Ft. RED SAND & SILT From 31 to 107 Ft. CLAY & ROCKS From 107 to 115 Ft. SAND</p>	

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4.0 PROGRAM FINDINGS

ANTWERP SPRINGS
WELL #1

4.1 Exploratory Test Drilling

Results of the exploratory test drilling indicate that the aquifer in which the existing large diameter Antwerp Springs well is completed, is confined and extends from 23 to 41 feet (6.4 to 12.5 metres) below surface at the site of the 6-inch test well. The confining layer is comprised of silt with organic material from 9 to 11 feet (2.7 to 3.4 metres) and clayey silt with minor sand from 11 to 23 feet (3.4 to 6.4 metres). The shallow aquifer is comprised of coarse gravel with minor sand and some clay. The driller's litholog for the 6-inch test well is as follows:

<u>Depth Interval In feet</u>	<u>Lithologic Description</u>
0 - 9	Sand and gravel (fill?), dry
9 - 11	Silt with organic material (wood fragments), dark grey
11 - 23	Clayey silt with minor sand, grey
23 - 41	Coarse gravel with some sand and minor clay, water-bearing
41 - 42	Clay

It is interesting to note that the shallow strata at the Antwerp Springs site appears to be dipping in a southward direction, in that the base of the aquifer in the 12-inch production well was encountered at 43 feet (13.1 metres), approximately 2 feet deeper than in the 6-inch test well. The new 12-inch well is located 6 feet (1.8 metres) south of the 6-inch test well.

4.2 Well Completion

The new shallow production well at the Antwerp Springs site is completed with 12-inch diameter, steel welded joint casing of 0.250" wall thickness. The screen assembly is comprised of 12-inch telescopic, Johnson's stainless steel well screen, set between 28 and 43.5 feet (8.5 and 13.3 metres) below surface. Because of the coarse nature of the aquifer material, the screen assembly is comprised of No. 250 slot size (250 thousandths of an inch slot openings) in the bottom portion and No. 200 slot size at the top. There is a blank section comprised of zero wind stainless steel screen and a Figure K packer attached to the top of the assembly. A well completion diagram is shown in Figure 4. A well location diagram is shown in Figure 5.



WATER WELL RECORD

Date 11 10 07

NTS MAP Z WELL No. ELEV Location Accuracy
U M Date 19 Well Type Page 1

Owners Name & Address District of Coldstream - ANTWERP SPRINGS WELL #2
Legal Description & Address

Descriptive Location Lanigan BC, Antwerp Springs

1. TYPE OF WORK: 1 New Well 2 Reconditioned 3 Deepened 4 Abandoned
2. WORK METHOD: 1 Cable tool 2 Bored 3 Jetted 4 Rotary a mud b air c reverse Other
3. WATER WELL USE: 1 Domestic 2 Municipal 3 Irrigation 4 Comm. & Ind. Other
4. DRILLING ADDITIVES NONE

9. CASING: 1 Steel 2 Galvanized 3 Wood 4 Plastic 5 Concrete Other

Hole Diameter						units
Diameter	12"					ins
from						ft
to						ft
Thickness						ins
Weight						lb/ft

5. MEASUREMENTS from 1 ground level 2 top of casing casing height above ground level ft.

Pitless unit ft 1 above 2 below ground level
1 Welded 2 Cemented 3 Threaded | 1 New 2 Used
Performations:

FROM ft	TO ft	6. WELL LOG DESCRIPTION	SWL ft
0	3	Compact clay and gravel	
3	18	Grey clay	
18	25	Grey clay little firm	
25	37	Grey clay	
37	38	Tight LENS cemented clay and gravel	
38	41	Med to large gravel clean	
41	46	Brown Sand and gravel small and clean	
46	52	Br Clay	
52	60	Grey clay med to soft	
60	70	Tight grey clay with gravel	
70	80	Tight cemented gravel with large cobbles	
80	91	Cemented gravel very tight with cobbles	
91	92	Very large cobbles to bed with small gravel very dirty and clay	
92	103	Tight cemented gravel with grey clay	
103	106	Cemented gravel with grey clay large cobbles	
106	109	Cemented gravel very tight	
109	109	med grey sand and gravel gravel med to small	

Shoe(s): PES
Open hole, from to ft Diameter ins
Grout:

10. SCREEN: 1 Nominal (Telescope) 2 Pipe Size
Type 1 Continuous Slot 2 Perforated 3 Louvre Other
Material 1 Stainless Steel 2 Plastic Other
Set from 18 ft to 20 ft below ground level

RISER, SCREEN & BLANKS						units
Length	17.11					ft
Diam. ID	12					ins
Slot Size	80 (60)					ins
from						ft
to						ft

Fittings, top R Parker bottom Ball
Gravel Pack

11. DEVELOPED BY: 1 Surging 2 Jetting 3 Air 4 Bailing 5 Pumping Other
12. TEST 1 Pump 2 Bail 3 Air Date 11 10 07
Rate USgpm Temp °C SWL before test ft
Water Level ft after test of hrs

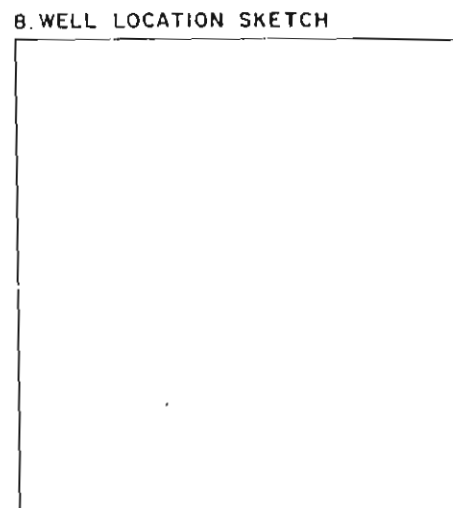
DRAWDOWN in ft				RECOVERY in ft			
mins	WL	mins	WL	mins	WL	mins	WL
SEE PUMP TEST RESULTS							

13. RECOMMENDED PUMP TYPE Sub RECOMMENDED PUMP SETTING 80 ft RECOMMENDED PUMPING RATE 900 USgpm

14. WATER TYPE: 1 fresh 2 salty 3 clear 4 cloudy colour smell ; gas 1 yes 2 no

15. WATER ANALYSIS: 1 Hardness mg/L 2 Iron mg/L 3 Chloride mg/L 4 pH Field Date

7. CONSULTANT
Address



SITE ID No Lab Date

16. FINAL WELL COMPLETION DATA
Well Depth 122.15 ft Well Yield USgpm
Static Water Level 34.92 ft Artesian Flow USgpm Pressure Head ft
Back filled
Well Head Completion Welded Rail

17. DRILLER (PLEASE PRINT) W. K. B. B. S. W. K. B. B. S.
Signature W. K. B. B. S.

18. CONTRACTOR, Address Robbins Waterwell Drg. & Pump Service, Box 117, Changan Falls, BC V0H 1R0

