Carcross Tagish First Nation Government

ISSUED FOR USE

SOURCE WATER PROTECTION PLAN
CARCROSS TAGISH FIRST NATION COMMUNITY WELLS
TAGISH, YT

W23101256

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EXECUTIVE SUMMARY

EBA Engineering Consultants Ltd. was retained by the Carcross Tagish First Nation Government (CTFN) to complete a Water Source Protection Plan for the Community Wells No. 2 and No. 3 in Tagish, Yukon. Key findings from this study are presented below:

- CTFN operates the CTFN Tagish water system and uses two water supply wells (Wells No. 2 and 3) intermittently to fill the water truck for bulk water delivery to 65 to 70 residents within the Community and the neighbouring communities.
- Both Wells No. 2 and No. 3 are completed within a deep confined aquifer; the top of the aquifer is at approximately 50 m-bgs. The thick overlying low permeable sediments (lacustrine clay and silt, till) along with the surface seal protection around the well casings, provides protection to the aquifer from surface-based contamination. The aquifer boundary is unknown.
- EBA estimated the vulnerability of the deep confined aquifer from which Wells No. 2 and No. 3 produce groundwater using the semi-quantitative Intrinsic Susceptibility Index (ISI) method. The ISI value for CTFN Wells No. 2 and No. 3, resulted in scores of 319 and 279, respectively, which indicates that the aquifer underlying the site has a low vulnerability to potential surface-based contamination because of thick overlying poorly permeable sediments.
- Available water level data indicate that the potentiometric groundwater level within the deep confined aquifer in the wellhead vicinity varies between approximately 1.4 and 4.0 m-bgs. At the time of the field reconnaissance in July 2009, the groundwater within the deep confined aquifer was inferred to flow in a northwesterly direction under a hydraulic gradient of approximately 0.02 m/m towards Six Mile River and Marsh Lake. However, historical groundwater elevations suggests that there may be seasonal fluctuations and potential changes or reversal of the flow direction.
- Based on previous pumping test results, the geometric mean of the aquifer transmissivity in the wellhead vicinity was estimated to be 3.7 m^2/day and this transmissivity value corresponds to a geometric mean of aquifer hydraulic conductivity of 0.40 m/day, assuming an apparent aquifer thickness of 9.2 m.
- The major recharge area for the aquifer is likely the topographic highs approximately 4 km southeast of the study area.
- The BC Tool Kit (STEP 2) Method for determining the best option for the Capture Zone Delineation was reviewed. A calculated fixed radius approach, and the approach using analytical equations were both considered and completed. However, due to limited number of wells in the study area, and the fact that historical data suggests that there are seasonal changes in groundwater flow direction, the analytical equation method was not considered appropriate. The capture zone was estimated using a modified, conservative calculated fixed radius approach.
- Risks identified within the 1-year, 5-year and 10-year travel time zones for the CTFN wells include the unused Well No. 1, a rock pit, miscellaneous wastes including car hulks and batteries, ASTs, USTs, septic systems, outhouses, the cemetery area, and potential spills that may occur.

However, these risks can be eliminated or reduced if preventive action and contingency planning is implemented developed.

- To date, no contamination has been identified in groundwater sampled from CTFN Community Wells No. 2 and No. 3; however, any release of contaminants within the wellhead protection area could represent a potential risk to the groundwater quality of the aquifer supplying the community wells.

EBA recommends that CTFN complete the following:

- Properly decommission Well No. 1 to eliminate potential conduit for short circuiting of contamination to the subsurface;
- Endorse and promote hazardous waste minimization and collection programs;
- Review and implement the risk management strategies to reduce or eliminate the risks identified during this study;
- Implement contingency planning including emergency response actions and communication. CTFN council should create an emergency and spill response plan identifying key personnel responsible to respond in the event of an occurrence or spill;
- Complete regular annual tracking and monitoring of all well risks (either with internal staff resources or outsourced to a consulting firm);
- Maintain security at community wells by ensuring the pump house door at Well No. 2 or wellhead enclosure cover at Well No. 3 are kept locked at all times;
- Maintain the Risk Map created for this study in a public part of the community, and update the Risk Map as necessary;
- Educate the CTFN community members regarding the importance of maintaining a clean environment within the water source protection area;
- Review and update the Water Source Protection Plan (WSPP) annually; and
- Incorporate this WSPP into the CTFN community development plan, which may result in:
  - Formal recognition and protection status for identified well protection zones such as those identified in this report;
  - Enforcement of well protection measures;
  - Restrictions on some land use activities within sensitive areas (within 10-year travel time zones) and well protection zones; and
  - Hydrogeological assessment as a requirement of development for land use activities considered as higher risk.

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1.0 INTRODUCTION

1.1 GENERAL

At the request of Mr. Mike Baerg, Operations and Maintenance Manger of Carcross Tagish First Nation Government (CTFN) Capital Projects, EBA Engineering Consultants Ltd. (EBA) has completed a Water Source Protection Plan (WSPP) for the two Community Wells currently serving the CTFN Tagish Community and some other non-First Nation communities in the Tagish and Squanga Lake areas. This work was completed in accordance with the Terms of Reference (January 2009) provided by Indian and Northern Affairs Canada (INAC) for a WSPP development. This project is funded under INAC's Yukon Region Capital Program First Nation Water and Wastewater Action Plan (FNWWAP) initiative.

1.2 PURPOSE AND SCOPE

A WSPP is intended to be used to identify, manage, mitigate, monitor, and communicate issues regarding quantity and quality of groundwater used as a potable water source. Groundwater ultimately entering a well comes from an area defined as a capture zone or a recharge area for that well. The basic objective of a WSPP is to provide realistic protective measures to practically manage activities in the capture zone or recharge area of a well or well field, to reduce potential risks of surface-based contamination.

The WSPP for the CTFN Community Wells has been developed to include the following three stages:

- Stage One – Risk Framework
- Stage Two – Risk Assessment
- Stage Three – Risk Management

2.0 SITE DESCRIPTION

2.1 LOCATION OF STUDY AREA

The CTFN community of Tagish is located on the east bank of the Six Mile River (also known as the Tagish River), just south of Highway 8 (Tagish Road) in southern Yukon, approximately 100 km south of Whitehorse. Figure 1 shows the subject site location.

2.2 EXISTING WATER AND WASTEWATER SYSTEMS

Residents in the CTFN Tagish community and other communities in the Tagish and Squanga Lake areas obtain their drinking water from the two CTFN operational wells (herein referred to as CTFN Community Well No. 2 and Well No. 3) through bulk water delivery. The CTFN Tagish water system consists of three 6.8 m^3 (1,500 Igal) water tanks, a chlorination injection system, and a manganese removal unit.

Well locations are shown on Figure 2, and well descriptions are provided below:

- Well No. 1 is a 152 mm (6") diameter well located inside the water truck garage building. CTFN Community Well No. 1 is currently not in use but was the original water supply well for the CTFN Tagish community. In 2003, a down-hole video inspection confirmed that the depth of Well No. 1 was approximately 25.6 m below grade and the well had not been completed with a screen. Access to Well No. 1 is only through the Water Truck Garage/Treatment plant building.
- Well No. 2 is a 203 mm (8") diameter 62.8 m deep well (below grade), located in a pump house approximately 55 m from the water truck garage. This well was drilled and completed in September 2003 by Midnight Sun Drilling to replace the old Well No. 1 which was reported to have a diminishing well yield and elevated turbidity. The well was completed with a 2.4 m long 0.254 mm (0.010") slot size screen exposed between 57.9 m and 60.4 m-bgs (below ground surface).
- Well No. 3 is a 203 mm (8") diameter 51.2 m deep well (below grade), located in a wooden box approximately 55 m northwest of the water truck garage (see Photograph 2). This well was drilled and completed in August/September 2004 by Cathway Water Resources of Whitehorse as a supplementary source of water supply for the water system. Well No. 3 was completed with a 1.2 m long, 0.508 mm (0.020") slot size screen set between 49.7 m and 51.2 m-bgs.

Wells No. 2 and 3 are both completed within a deep confined aquifer at approximately 50 m-bgs and according to the log of Well No. 2, the apparent aquifer thickness is approximately 9.2 m. However, due to the limited number of wells in the study area, it is not possible at this stage to delineate the extent of this deep confined aquifer.

In addition to the CTFN community wells, there is an unused well at the north end of the campground site. The campground well was a flowing artesian well with a water level of 3.4 m above grade and was completed at 105 m below grade with a 0.457 mm (0.018") slot size screen at the well bottom. This well has not been in use for several years due to elevated arsenic concentrations. This well is reported to be the deepest well in the study area.

Driller's well logs for the two operational wells are included as Appendix A. Well construction details for all three CTFN wells and also the campground well are included in Table 1. A summary of subsurface conditions encountered at Well No. 2 and Well No. 3 are included in Tables 2A and 2B, respectively.

Wastewater generated from the sinks and the toilet in the water truck garage is discharged to a septic holding tank and the wash water from the water truck drains to a rock pit. Both the holding tank and the pit are located south of the water truck garage and are pumped out when required. The old septic field for the original condemned water truck garage has been disconnected and is no longer in use. The old septic field is located south of the buildings.

Available historical operational data (January 2008 to February 2009) for the two operational wells are included in Appendix B.

2.3 HYDROGEOLOGY

2.3.1 Surficial and Bedrock Geology

Bedrock underlying the overburden sediments is mapped as the Lower and Middle Jurassic Laberge Group which consists of poorly sorted, medium bedded to massive arkosic sandstone and minor shale with interbeds of thick resistant pebble and boulder conglomerate. Bedrock was not encountered at any of the CTFN community wells; thus, expected depth to bedrock is unknown.

According to available surficial mapping (Morison & Klassen 1991), the Laberge Group formation is overlain by any or all of the followings:

1. Alluvial valley bottom deposits of gravel, sand, and silt with a thickness of 5 m to 20 m;
2. Glaciolacustrine deposits of clay, silt, and sand with a thickness of 5 m to 10 m; and/or,
3. Silty to sandy till (lodgement to ablation till) deposits of 1 m to 30 m thick.

According to the well logs from Community wells No. 2 and No. 3, both wells are completed in a deep confined aquifer, which is overlain by a thick clay and/or silty to sandy till unit that is at least 18 m in thickness.

2.3.2 Hydraulic Gradient and Groundwater Flow Direction

Based on the July 21st 2009 groundwater elevation data, the groundwater flow direction within the aquifer at that time was estimated to be northwesterly towards Marsh Lake, under a hydraulic gradient of 0.02 m/m.

Periodic water level measurements for the CTFN wells are tabulated in Table 3 below. As shown in Table 3, limited water level data have been collected since the wells began operation. The water level in Well No. 2 varied between 1.37 m-bgs in October 2003 and 3.42 m-bgs in June 2009, while the water level in Well No. 3 varied between 2.58 m-bgs in July 2009 and 3.99 m-bgs in September 2004. The water level measurement taken in October 2003 indicated a higher hydraulic head in Well No. 2 than in Well No. 1, which is the opposite of what was observed in July 2009. There was some uncertainty with regard to the measurement in Well No. 1 because this well was operational at that time and the well water level appeared to be still recovering while the measurement was taken. However, a very similar water level had also been observed in August 2003, and these data may suggest that the groundwater flow direction could change seasonally and even reverse temporarily.

Insufficient data are currently available to determine the actual magnitude of seasonal fluctuation and potential changes of the hydraulic gradient and groundwater flow direction.

TABLE 3: PERIODIC WATER LEVEL MEASUREMENTS

Date	CTFN Well No. 1			CTFN Well No. 2			CTFN Well No. 3		
	Well Casing Stickup	Depth to Water	Hydraulic Head*	Well Casing Stickup	Depth to Water	Hydraulic Head*	Well Casing Stickup	Depth to Water	Hydraulic Head*
	(m)	(m-bgs)	(m-asl)	(m)	(m-bgs)	(m-asl)	(m)	(m-bgs)	(m-asl)
Aug-14-03	0.33	2.57	657.91	–	–	–	–	–	–
Oct-30-03	0.33	2.52	657.96	1.65	1.37	658.62	–	–	–
Sep-03-04	–	–	–	–	–	-	0.61	3.99	656.11
Jun-02-09	–	–	–	1.62	3.42	656.57	0.41	5.86 (recovering level)	654.24 (recovering level)
Jul-21-09	0.16	2.01	658.54	1.62	2.48	657.51	0.41	2.58	657.52

Note: "–" indicates no measurement was collected on at particular date.
* Assumed grade elevation at Well No. 3 is 660 m-asl.

2.3.3 Aquifer Transmissivity and Hydraulic Conductivity

Based on pumping test results of Wells No. 2 and No. 3, the transmissivity of the deep confined aquifer in the study area ranged from 2.1 to 5.3 m^2/day, with a geometric mean of 3.7 m^2/day (4.3×10^{-5} m^2/s) (EBA 2004 and PHCL 2004). These transmissivity values, along with an apparent aquifer thickness of 9.2 m, correspond to an aquifer hydraulic conductivity range of 0.22 to 0.58 m/day, or a geometric mean of 0.40 m/day (4.6×10^{6}m/s).

2.3.4 Aquifer Recharge Areas

The main source of aquifer recharge is inferred to be from topographic highs surrounding the valley. Local recharge to the aquifer from precipitation and snowmelt is probably very limited because of the confined aquifer conditions and the relatively thick cover with poorly permeable sediments. Given an inferred predominant groundwater flow direction toward northwest, the main aquifer recharge area is likely to be from the topographic highs approximately 4 km southeast of the well site. The base elevation of the elevated upland is approximately 762 m above sea level (m-asl) and the peak elevation is approximately 1,282 m-asl.

There is a marsh/swamp area approximately 1.5 km south of the well site. This marsh/swamp is likely perched on low permeable sediments (i.e., clay) at or near surface and is not likely to be a primary recharge source to the wells.

2.3.5 Aquifer Vulnerability

Based on the available information on the logs of Wells No. 2 and No. 3, several discontinuous till layers consisting of silty and sandy gravel with some clay were encountered at both wells.

EBA estimated the vulnerability of the deep confined aquifer from which Wells No. 2 and No. 3 produce groundwater using the semi-quantitative Intrinsic Susceptibility Index (ISI) method suggested by the Ontario Ministry of Environment (2001). This method is deemed to provide a reasonable estimation on the aquifer vulnerability. The vulnerability level of an aquifer is a measure of the aquifer's risk exposure likelihood should a contaminant be introduced into the subsurface, e.g., by spills or leaks of any contaminant sources.

An ISI value of 0 to 30 indicates a high vulnerable aquifer, a value of 30 to 80 indicates medium vulnerability, and a value greater than 80 suggests low vulnerability.

The ISI value for a confined aquifer is calculated by summing the product of the effective thickness of each geological unit and the corresponding K-factor (based on generic representative soil/bedrock permeability), from the ground surface to the top of the aquifer.

The ISI value for CTFN Wells No. 2 and No. 3, resulted in scores of 319 and 279, respectively, an indication that the aquifer underlying the site has a low vulnerability to potential surface-based contamination because of thick overlying poorly permeable lacustrine and till sediments above the aquifer and the great depth of the aquifer zone. Relevant data used for the ISI method are presented in Tables 2A and 2B.

2.3.6 Surface Water Hydrology and General Watershed Conditions

Data obtained from the Water Survey of Canada online database for Station 09AA017 (Tagish Lake at 10 Mile Road, YT, 1995 to 2008) include the historical high, average, and low water levels; peak lake level timing; and seasonal variations.

The historical stream flow statistics of Six Mile River show that snowmelt in the Tagish area typically occurs in the late spring. The available data show that the high level condition at Station 09AA017 usually occurs in August and the low level occurs during mid-May to early June. The observed average seasonal water level fluctuation at 09AA017 had been in the order of 2.5 m.

EBA completed a Groundwater Under the Direct Influence of Surface Water (GUDI) study for the CTFN community wells to determine whether the CTFN community wells were potentially under the influence of the Six Mile River. A final report for this study was presented to CTFN in October, 2009 (EBA 2009). Based on the initial GUDI screening, both CTFN Community Wells No. 2 and No. 3 are considered non-GUDI wells for the following reasons:

- The wells were drilled and completed in a deep confined aquifer with at least 18 m clay and till overlying the aquifer to provide protection from surface sources of contamination.

- The nearest surface water body to the Tagish Wells is the Six Mile River, which is located at distances greater than the more stringent 100 m screening criteria of the Ontario GUDI guidelines and the travel time from the River to the Community Wells is at least 150 days.
- The wells were constructed with continuous casings, sanitary seals, and adequate stick-ups.
- The water chemistry of the two Community Wells and the Six Mile River are distinctively different in a number of major parameters, such as electrical conductivity, total dissolved solids, sulphate, sodium etc. Only 2 of the 76 bacteriological results of CTFN Community Well No. 2 showed a positive total coliform hit and only one was detected in Well No. 3 for the 67 samples collected. Re-test results were negative.

3.0 STAGE ONE – RISK FRAMEWORK

3.1 RISK APPROACH

The initial step towards a risk-based WSPP is to determine the appropriate risk approach for the project. Risk identification can be qualitative (a descriptive assessment of the risk elements: hazards, exposure likelihood, and receptor) or quantitative (based on numerical and probabilistic mathematical analysis of the risk elements). From the onset of the project, it was deemed sufficient to use a qualitative approach.

3.2 RESPONSIBLE PARTIES

The responsible parties in the context of this risk-based WSPP are the community well owners, that is, the CTFN as represented by the Chief and Council. INAC also shares responsibility by having fiduciary responsibility and by providing funding for this project.

3.3 RISK MANAGEMENT TEAM

One of the important steps to successful development and implementation of a WSPP is to form a community planning team which we recommend should include the following:

- CTFN Chief and Council members;
- INAC representative;
- Water purveyors and water operators (i.e., Mr. Mike Barge, CTFN Capital Project Director; and/or Mr. Gordon Wally, CTFN Tagish water system operator);
- A number of members from the CTFN Tagish Community; and
- A groundwater professional.

The community team shall be formed during a meeting following the completion of this report. EBA will take the lead and chair the meeting and deliver a presentation on the WSPP.

3.4 RISK TOLERANCE

Risk tolerance is a measure of the acceptable level of risk by the responsible parties (owner). A risk-tolerant owner would be able to accept or transfer some level of risk, while a risk-averse owner would seek to eliminate or transfer all but the lowest levels of risk to the water supply. The CTFN, perhaps with input from the community WSPP team, should determine their risk tolerance, so that future decisions regarding how to deal with the risks identified in this study can be implemented.

4.0 STAGE TWO – RISK ASSESSMENT

4.1 WELL CAPTURE ZONE

The well capture zone area is a key element in a WSPP as it is the geographic area that in theory contributes groundwater to a well. The size and shape of the capture zone depends upon the hydrogeological setting and the design and operational characteristics of the well.

Based on the limited spatial data available, there is significant uncertainty regarding the groundwater flow direction, hydraulic gradient, and potential seasonal changes of the groundwater flow regime. Groundwater elevation data are only available for the three community wells, and it is unclear if Well No.1, which is considerably shallower than Wells No. 2 and No. 3, is fully hydraulically connected to the deeper aquifer. A comparison of hydraulic head data collected in 2009 with those collected in 2003 (EBA 2004) suggests that the flow direction may have been in a southerly direction in 2003, i.e., in the reverse direction compared to the hydraulic gradient inferred from measurements in 2009 (see Section 2.3.2).

The methods that were considered for calculating the capture zone geometry were numerical modelling, arbitrary fixed radius, calculated fixed radius, and the analytical equations methods. There was insufficient spatial data (only 3 wells that are very close together) and seasonal data to complete numerical modelling (an option presented in our proposal if there was sufficient monitoring network and data). The arbitary fixed radius method was not used as it is very simplistic, and not based on the actual hydrogoelogical conditions. The analytical equation method was completed for the groundwater flow direction and gradient observed by EBA on July 21. This method requires, however, that there be uniform ambient groundwater flow and gradient. Due to the limited monitoring network, uncertainty in flow direction, and potential seasonal reversal of the flow direction, the calculated fixed radius approach was selected as the most appropriate method. The calculated fixed radius approach was modified to provide a more conservative estimate of the well capture zones to further address the uncertainty regarding the groundwater flow regime. The calculation of the well capture zones involved the following three steps:

- Determination of the average pumping rate: Based on the well use records for the year of 2008, EBA determined the average pumping rate for the Wells No. 2 and No. 3

(0.08 L/s and 0.09 L/s, respectively). The sum of both pump rates was used (0.17 L/s) to account for the possibility that only one well may be used for drinking water production in the future. To allow for potential future expansion, the average pump rate was doubled resulting in an average pump rate of 0.34 L/s that was used to calculate the well capture zones.

- The radius of the well capture zones for one, five, and ten years travel time were calculated using the following equation (calculated fixed radius, BC Well Protection Toolkit):

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

Where:

- r is the calculated radius around the pumping wells (m)
- Q is the average pumping rate (L/s) of the wells;
- t is the allowed travel time to the wells (years), specified as one-year, five-year, and ten-year period;
- n is the aquifer porosity (assumed to be 0.25 which is a typical value for sand aquifers); and
- b is the screen length (m).

- To provide an even more conservative estimate of the well capture zones, the travel distances for the one-year, five-year, and ten-year period were calculated using the natural gradient of 0.02 m/m inferred from hydraulic head measurements in the Wells No. 1, No. 2, and No. 3 in July 2009. The travel distance can be determined as follows:

$$D_{TOT} = \frac{t * K * i}{n}$$

Where:

- D_{TOT} is the distance representing the 1-, 5- and 10-year time of travel (in years);
- t is time (in years);
- K is the hydraulic conductivity (geometric mean) of the aquifer (in m/y) (detailed in Section 4.3 to be 0.40 m/day (4.6×10^{-6} m/s));
- i is the estimated hydraulic gradient under non-pumping conditions; and
- n is porosity of the aquifer (assumed to be 0.25);

The flow distance for one, five, and ten years travel time were then added to the well capture zone radii determined by the calculated fixed radius method. A summary is presented in Table 4:

TABLE 4: SUMMARY OF THE WELL CAPTURE ZONE RADII FOR WELLS NO. 2 AND 3			
	Calculated fixed radius method	Travel distance due to natural gradient	Total capture zone radius
	(m)	(m)	(m)
Sanitary Zone (90 day)	10	2.5	**12.5**
Zone 1 (one-year)	40	10	**50**
Zone 2 (five-year)	90	60	**150**
Zone 3 (ten-year)	130	120	**250**

Because the Wells No. 2 and No. 3 are located in close proximity and the well capture zones overlap, both capture zones have been combined into one well capture zone as shown in Figure 2.

4.2 POTENTIAL RECEPTORS

Potential human receptors are the users of the Community Wells, as previously noted in Section 2.1 of this plan, namely, the CTFN residents who receive trucked water from the Community Wells.

4.3 IDENTIFICATION OF RISK SCENARIOS

Risk can be defined as a potential exposure of a receptor to a hazard. Risk assessment is the process of evaluating the consequences of hazard severity and likelihood of exposure, then evaluating, ranking and mapping the identified risk scenarios. The three key elements of risk (exposure, hazard, and receptors) must all combine to generate risk. Risk can be effectively removed or reduced to acceptable levels if any of the three elements are eliminated or blocked. Exposure can be expressed in terms of the likelihood of a receptor (e.g., humans, animals and plants) coming into contact with a hazard. Hazards can be expressed in terms of severity (contaminant toxicity). To be practical and conservative, the evaluation of a hazard in this analysis assigns the highest potential concern that may be present at the wellhead for that hazard (i.e., no retardation or reduction in hazard severity along its travel path to the well).

In order to assess potential risks to the Community Wells, EBA identified existing and potential hazards and then plotted these hazards on a map in relation to the capture zones. EBA used several different methods to identify potential hazards near and within the capture zones, including:

- Meeting with Mr. Gordon Wally, water system operator of CTFN, to collect anecdotal information (completed on July 21, 2009);
- Site reconnaissance (completed on July 21, 2009);
- Reviewing current and historical maps for the area for surrounding land uses;

- Completing a large area search (5 km radius of the site) for spills records within Environment Canada (EC) Environmental Protection Branch Spills Records that search for spills up to 2001;
- Completing a large area search (5 km radius of the Site) for contaminated sites and spills within the Government of Yukon (YG), Department of Environment, Environmental Programs Branch; and
- Reviewing previous relevant reports.

4.4 POTENTIAL CONTAMINANT SOURCES IN VICINITY OF CTFN OPERATIONAL WELLS

During the July 21, 2009, site investigation, EBA personnel identified and inventoried the potential contaminant sources within the CTFN Tagish Community and the YTG campground, as well as the privately-owned parcels north of Highway 8 (see Table 5). The identified potential contaminant sources were documented and recorded by GPS, with their approximate locations plotted on Figure 2 to show their distances to the community wells. A list of the types of potential contaminant sources identified are listed:

- Well # 1 (not properly decommissioned)
- Above-ground fuel storage tanks
- Outhouses
- Underground fuel storage tanks
- Sewage holding tanks
- Septic Fields
- CTFN Cemetery
- Miscellaneous wastes (car hulk, batteries, drums, old automobile parts, household wastes)
- Potential Spills
- Cemetery
- Potential Dump Areas
- Documented Spill Locations

4.5 CONTAMINATED SITES AND SPILLS SEARCH, ENVIRONMENT CANADA

Environment Canada (EC) maintains the 1972 to 2001 records of spills in the Yukon. After 2001, the responsibility was transferred to the Yukon Government (YTG).

A 5 km search radius from the well site was requested from EC for historical spill records and a total of six spills were identified within the search area. Of the six reported spills, only one was identified near the CTFN wells. The incident occurred in 1995 at the Tagish

Marina as a result of gasoline leakage from a fuel storage tank. The quantity of gasoline leakage was unknown. The spill was identified as EC1 on Figure 2.

The correspondence between EC and EBA is also presented in Appendix C.

4.6 CONTAMINATED SITES AND SPILLS SEARCH, GOVERNMENT OF YUKON

YTG Department of Environment's (YTG-DE) Environmental Programs Branch maintains the post-2001 Yukon spills reports. A 5 km search radius from the well site was requested from YTG-DE for historically reported spills.

A total of two Contaminated Sites records were identified within the search area, one relating to the Tagish Bridge Dump and the other relating to the old sewage lagoon. The Tagish Bridge Dump is located approximately 1 km east of Tagish on Highway 8 (at approximately Mile 16 mark); the Dump was decommissioned in 1998. The old sewage lagoon was located on Lot 1100 Quad 105D/08 and was closed in 2008. Both sites are located on the west side of Six Mile River, at a distance of at least 4 km from the study area.

The correspondence between YTG-DE and EBA is also presented in Appendix C.

4.7 REVIEW OF HISTORICAL REPORTS REGARDING FORMER MILITARY DUMPS IN YUKON

4.7.1 INAC – 1993: Use Disposal and Transportation of Selected Contaminants in Yukon

EBA reviewed the Use, Disposal and Transportation of Selected Contaminants in Yukon (Nordin et al.) which documents the historical use, transportation and disposal of selected contaminants in the Yukon between 1910 and 1980 with particular emphasis on the period of 1940-1970.

The document makes no mention of any potential sites that reference the Tagish town site.

4.7.2 INAC - 1995: Research of Former Military Sites & Activities in the Yukon – Action on Waste Program Arctic Environmental Strategy (AES)

EBA reviewed the Research of Former Military Sites and Activities in the Yukon (Bisset, K., Fozard, J.S.) which reviewed former military sites and activities in the Yukon, during World War II and afterwards to the 1970's.

The document makes no mention of any potential sites that reference Tagish town site.

4.8 SURROUNDING LAND USES

The CTFN Tagish watershed property is bounded by undeveloped lands (CTFN community land C41-B) to the south, the CTFN Tagish community to the east and CTFN rural land R-40B, a private residence and Six Mile River to the west and the YTG campground, Highway 8 and private commercial and residential lands and CTFN rural land R-16B to the north.

4.9 RISK EVALUATION AND MAPPING

The estimate of risk for each hazard takes into account several factors including:

- Size and magnitude of the hazard (point source or non-point source);
- Location (i.e., distance from well(s));
- Groundwater travel time to the well(s);
- Aquifer vulnerability;
- The likelihood of the contaminant of concern directly affecting water at the well, and;
- The severity of the hazard to the user from contaminants entering the well.

The above mentioned considerations were used to define the categories of exposure likelihood and hazard consequence. Table 6 also provides some rationale for assigning a "Very Low", "Low", "Medium", or "High" potential value to exposure likelihood and hazard consequence.

TABLE 6: EXPOSURE AND HAZARD CATEGORIES

Chemical Exposure Likelihood (In consideration of "Low" Aquifer Vulnerability)	
Little to None	Outside Capture Zone for Community Well
Very Low	Within 5 to 10 year horizontal travel time
Low	Within 1 to 5 year horizontal travel time
Medium	Within 0 to 1 year horizontal travel time
High	Where there is a potential short circuit to aquifer (such as improperly decommissioned well)
Bacteriological Exposure Likelihood (In consideration of "Low" Aquifer Vulnerability)	
Little to None	Outside Capture Zone for Community Well
Very Low	Within 1 to 10 year horizontal travel time
Low	Within 1 to 5 year horizontal travel time
Medium	Within 90 day to 1 year horizontal travel time
High	Within 90 day travel time
Hazard Consequence	
Low	Exceeds aesthetic objectives in drinking water guidelines
Medium	Short-term health conditions or water quality concerns (Lost time: days to months)
High	Chronic to Acute health hazard (Permanent Disabilities or fatalities)

Table 7 represents a summary of risk scenarios within the capture zone radii identified in Table 4. The risk rank results are a function of applying the hazard scenario to the risk matrix framework, which will provide an overall risk ranking for individual contaminant sources. Since the 1-year, 5-year, 10-year travel times are the horizontal travel times, and the aquifer in which the Community Wells No. 2 and No. 3 are completed are very low vulnerability (as indicated in the ISI index), the exposure likelihoods are generally relatively low. This differs from other communities where the groundwater aquifer used for water

supply is unconfined or nearer to surface and does not have protection offered by low permeability soils overlying the aquifer.

TABLE 7: AREAS OF POTENTIAL ENVIRONMENTAL CONCERN WITHIN CAPTURE ZONES

I.D.	Hazard Description	Exposure Likelihood	Hazard Consequence	Risk Rank
	CTFN Wells No. 2 and No. 3			
CTFN Well No. 1	Existing CTFN Well No. 1	High	High	**High**
MW1	Miscellaneous waste within the 1 year travel time zone	Medium	High	**High**
AST1	Above ground storage tank within the 1 year travel time zone	Low[1]	High	**Medium**
PS1	Potential Spill within the 1 year travel time zone	Medium	High	**High**
MW5	Miscellaneous waste within the 5 year travel time zone	Low	High	**Medium**
RP1	Rock Pit – wash bay sump; possible hydrocarbons and/or solvents	Low	High	**Medium,**
ST5	Sewage Holding Tank/Septic Field within the 5 year travel time zone	Very Low	High	**Low**
AST5	Above ground storage tank within the 5 year travel time zone	Low	High	**Medium**
O5	Outhouse within the 5 year travel time zone	Very Low	High	**Low**
PS5	Potential Spill within the 5 year travel time zone	Low	High	**Medium**
AST10	Above ground storage tank within the 10 year travel time zone	Very Low	High	**Low**
O10	Outhouse within the 10 year travel time zone	Very Low	High	**Low**
Cemetery	Cemetery within the 10 year travel time zone	Very Low	High	**Low**
PS10	Potential Spill within the 10 year travel time zone	Very Low	High	**Low**

Notes: **1** – Exposure likelihood downgraded since there is secondary containment.

The risk matrix (Figure 3) provides the potential risk posed by each hazard located within the well capture zones for the CTFN Community Wells. The overall risk of "low", "medium", or "high" is assigned to each potential hazard identified within the capture zones and is based on the combined exposure likelihood and hazard consequence for each potential contaminant source.

The resulting risk ranks "high", "medium", and "low" are then plotted on the Risk Map by using colors to represent different risk categories (Red=High, Yellow=Medium and Green=Low) (Figure 2).

Understanding, tracking, and managing identified risks become simple and intuitive through the use of a risk maps. Figure 2 shows the estimated travel times associated with the Community Wells (1 year, 5 year and 10 year travel time zones). Risk scenarios were plotted

on the Risk Map using different symbols to represent their potential contaminant sources and colors to represent the risk category for the potential contaminant source.

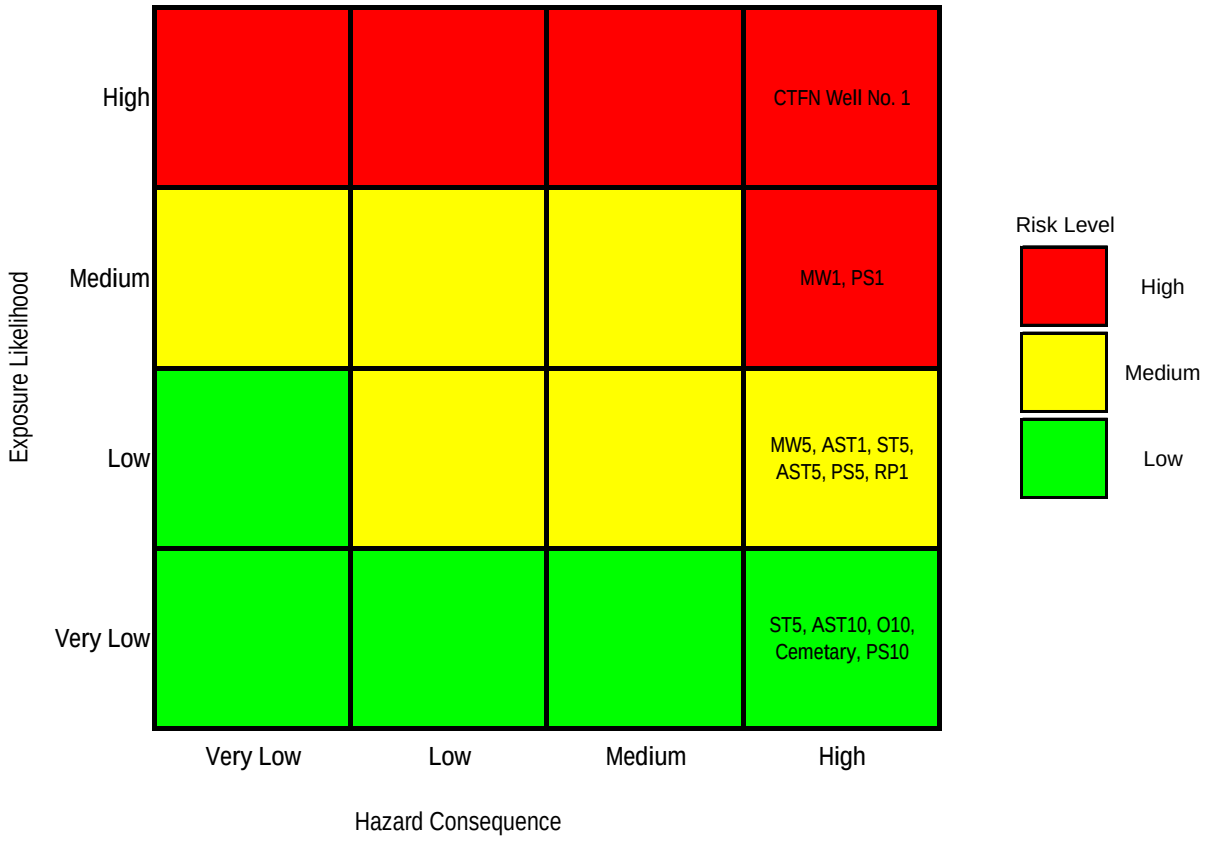

Figure 3: Risk Matrix

Note: Figure 3 is originally produced in color; non-color reproductions may not be representative of the original

The Risk Maps are the key deliverable and form the basis for the WSPP. The Risk Maps are also presented in a Risk Information Poster for the CTFN Community.

The Risk Database and Risk Maps represent the current conditions of the wells and aquifer and should not be considered as a static "one-time" item. The Risk Database and Risk Maps should be updated as new risks are identified and as known risks are managed to low levels and taken off the database.

5.0 STAGE THREE – RISK MANAGEMENT

5.1 RISK MANAGEMENT STRATEGY

The risk management strategy integrates information collected during the capture zone delineation and hazard identification steps and provides workable strategies for preventing,

detecting, and responding to wellhead protection risks. The following includes examples of such strategies:

- Endorsing and promoting recommended management practices;
- Providing public and landowner information sessions and training; and
- Implementing action and management strategies provided in Table 8.

Some of the scenarios identified are *potential* rather than existing threats to the CTFN Community Wells No. 2 and No. 3. Therefore, risk management strategies for this site should include a preventive action and contingency planning in the event that one of the potential hazard scenarios occurs.

The Risk Maps and Risk Information Poster can form a concise and convenient basis for communicating information regarding the status of potential threats to all stakeholders including the risk management team, water system operators, community organizations, or municipal councils. Frequent reporting is important to document progress, improve public perception, reduce potential legal issues, and possibly reduce insurance costs.

5.2 RISK REDUCTION PLAN

A Risk Reduction Plan involves pre-planning actions to respond to identified risks situated within the capture zones. For example, this would include emergency response actions and communication should a contaminant release (e.g., spill from a fuel truck) occur within a well capture zone. Table 8 on the following page summarizes potential strategies to be considered in order to reduce or eliminate the risk previously identified.

5.3 RISK MONITORING

A Risk Monitoring Plan involves periodic review, auditing and updating of the Risk Maps and Risk Database. Once a WSPP is in place, continued implementation and at least annual monitoring of the program is essential to protect the wells and reduce risks to users.

TABLE 8: RISK REDUCTION/ ELIMINATION STRATEGIES TO BE CONSIDERED

I.D.	Hazard Description	Current Risk Rank	Risk Reduction Option to Consider	Risk Elimination Option to Consider
CTFN Well No. 1	Existing CTFN Well No. 1	High	Ensure well head is not accessible and/or available for tampering	Decommission Well (recommended since no longer use)
HW1, HW5	Household waste within the 1 and 5 year travel time zones	High to Medium	Monitor car hulks, old barrels and battery storage for leaks or spills. Implement spill contingency plan.	Remove current wastes and do not allow wastes to build up in WSPP zones (recommended)
AST5, AST10	Above ground storage tank within the 1, 5 and 10 year travel time zones	Medium to Low	Secondary Containment. Flex Hose. Implement spill contingency plan. Ensure that fuel delivery personnel exercise extreme caution when refilling of ASTs. A CTFN representative should act as a spotter during filling of all ASTs.	Replace with propane systems.
RP1	Rock Pit	Medium	Oil Water Separator	Install Holding Tank
PS1, PS5, PS10	Potential Spill within the 1, 5 and 10 year travel time zones	High to Medium	Implement spill contingency plan.	N/A
ST5, ST10	Sewage Holding Tanks and On-site Sewage Disposal System within the 5 and 10 year travel time zones	Low	Educate and train owners how to properly maintain these systems. Implement a monitoring system to ensure proper operation and timely pump-out	Ensure that all septic tanks and fields are registered with environmental health and implement a yearly monitoring program to ensure proper system operation.
O5, O10	Pit Privies/ Outhouse within the 5 and 10 year travel time zones	Medium	Ensure that wastes are pumped out regularly and that surface drainage is routed away from outhouse pits.	Replace with pump out system
Cemetery	Cemetery within the 10 year travel time zone	Medium	do not allow new burials at existing cemetery location	N/A

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 CONCLUSIONS

EBA has developed this WSPP for the CTFN Community Wells No. 2 and No. 3 located in Tagish, Yukon. Based on the findings of this study, EBA concludes the following:

- CTFN operates the CTFN Tagish water system and uses two water supply wells (Wells No. 2 and 3) intermittently to fill the water truck for bulk water delivery to 65 to 70 residents within the Community and the neighbouring communities.
- Both Wells No. 2 and 3 are completed within a deep confined aquifer; the top of the aquifer is at approximately 50 m-bgs. Bedrock was not encountered at either well and according to available hydrogeological information; depth to bedrock in the study area is expected to be more than 105 m. The thick overlying low permeable sediments described by the driller as till consisting of silty and sandy gravels with some clay, along with the surface seal protection around the well casings, provides protection to the aquifer from surface-based contamination. The aquifer boundary is unknown.
- EBA estimated the vulnerability of the deep confined aquifer from which Wells No. 2 and 3 produce groundwater using the semi-quantitative Intrinsic Susceptibility Index (ISI) method. This method is deemed to provide a reasonable estimation on the aquifer vulnerability. An ISI value of 0 to 30 indicates a high vulnerable aquifer, a value of 30 to 80 indicates medium vulnerability, and a value greater than 80 suggests low vulnerability. The ISI value for CTFN Wells No. 2 and No. 3, resulted in scores of 319 and 279, respectively, an indication that the aquifer underlying the site has a low vulnerability to potential surface-based contamination because of thick overlying poorly permeable till sediments.
- Available water level data indicate that the potentiometric groundwater level within the deep confined aquifer in the wellhead vicinity varies between approximately 1.4 and 4.0 m-bgs. The groundwater within the deep confined aquifer flows in a northwesterly direction under a hydraulic gradient of approximately 0.02 m/m towards Six Mile River and Marsh Lake; however, insufficient data is currently available to assess seasonal fluctuations and potential changes or reversal of the flow direction as might be indicated by previous water level measurements.
- Based on previous pumping test results, the geometric mean of the aquifer transmissivity in the wellhead vicinity was estimated to be 3.7 m^2/day (4.3×10^{-5} m^2/s) and this transmissivity value corresponds to a geometric mean of aquifer hydraulic conductivity of 0.40 m/day (4.6×10^{-6} m/s), assuming an apparent aquifer thickness of 9.2 m.
- The recharge area for the aquifer is likely the topographic highs approximately 4 km southeast of the study area.
- Due to limited existing spatial data and due to the uncertainty with respect to potential seasonal changes in the groundwater flow regime, the capture zone was estimated using a modified, conservative calculated fixed radius approach.
- Risks identified within the 1-year, 5-year and 10-year travel time zones for the CTFN wells include: the unused Well No. 1, miscellaneous household wastes including car hulks and batteries, ASTs, USTs, septic systems, outhouses, the cemetery area and

potential spills that may occur. However, these risks can be eliminated or reduced if preventative action and contingency planning can be developed.

- To date there has been no identified contamination in groundwater sampled from CTFN Community Wells No. 2 and No. 3; however, any release of contaminants within the travel time zones would represent a potential risk to the groundwater quality of the aquifer supplying the community wells.

6.2 RECOMMENDATIONS

EBA recommends that CTFN complete the following:

- Endorse and promote hazardous waste minimization and collection programs;
- Review and implement the risk management strategies to reduce or eliminate the risks identified during this study;
- Properly decommission Well No. 1 to eliminate potential conduit for short circuiting of contamination to the subsurface;
- Implement contingency planning including emergency response actions and communication. CTFN council should create an emergency and spill response plan identifying key personnel responsible to respond in the event of an occurrence or spill;
- Complete regular annual tracking and monitoring of all well risks (either with internal staff resources or outsourced to a consulting firm);
- Maintain security at community wells by ensuring the pump house door at Well No. 2 or wellhead enclosure at Well No. 3 are kept locked;
- Maintain the Risk Map created for this study in a public part of the community, and update the Risk Map as necessary;
- Educate the CTFN community members regarding the importance of maintaining a clean environment of the land surrounding their community wells;
- Review and update the WSPP annually; and
- Incorporate this WSPP into the CTFN community development plan, and develop a Groundwater Protection Program for the area. This Groundwater Protection Program should consist of the following:
  - Formal recognition and protection status for identified well protection zones such as those identified in this report;
  - Enforcement of well protection measures;
  - Restrictions on some land use activities within sensitive areas (within 10-year travel time zones) and well protection zones; and
  - Hydrogeological assessment as a requirement of development for land use activities considered as higher risk.

7.0 LIMITATIONS OF REPORT

This report has been prepared specifically for Carcross Tagish First Nation Government for the purposes described in Section 1.2 of this report. The report has been prepared in accordance with generally accepted geo-environmental practices. Additional information regarding the use of this report is presented in the Geo-environmental Report - General Conditions (attached), which form a part of this report.

This report and its contents are intended for the sole use of Carcross Tagish First Nation Government and their agents. EBA does not accept any responsibility for the accuracy of any of the data, the analysis or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than Carcross Tagish First Nation Government, or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Use of this report is subject to the terms and conditions stated in EBA's Services Agreement. EBA's General Conditions are provided in Appendix D of this report.

8.0 CLOSURE

We trust this report meets your present requirements. Should you have any questions or comments, please contact the undersigned at your convenience.

Respectfully submitted,
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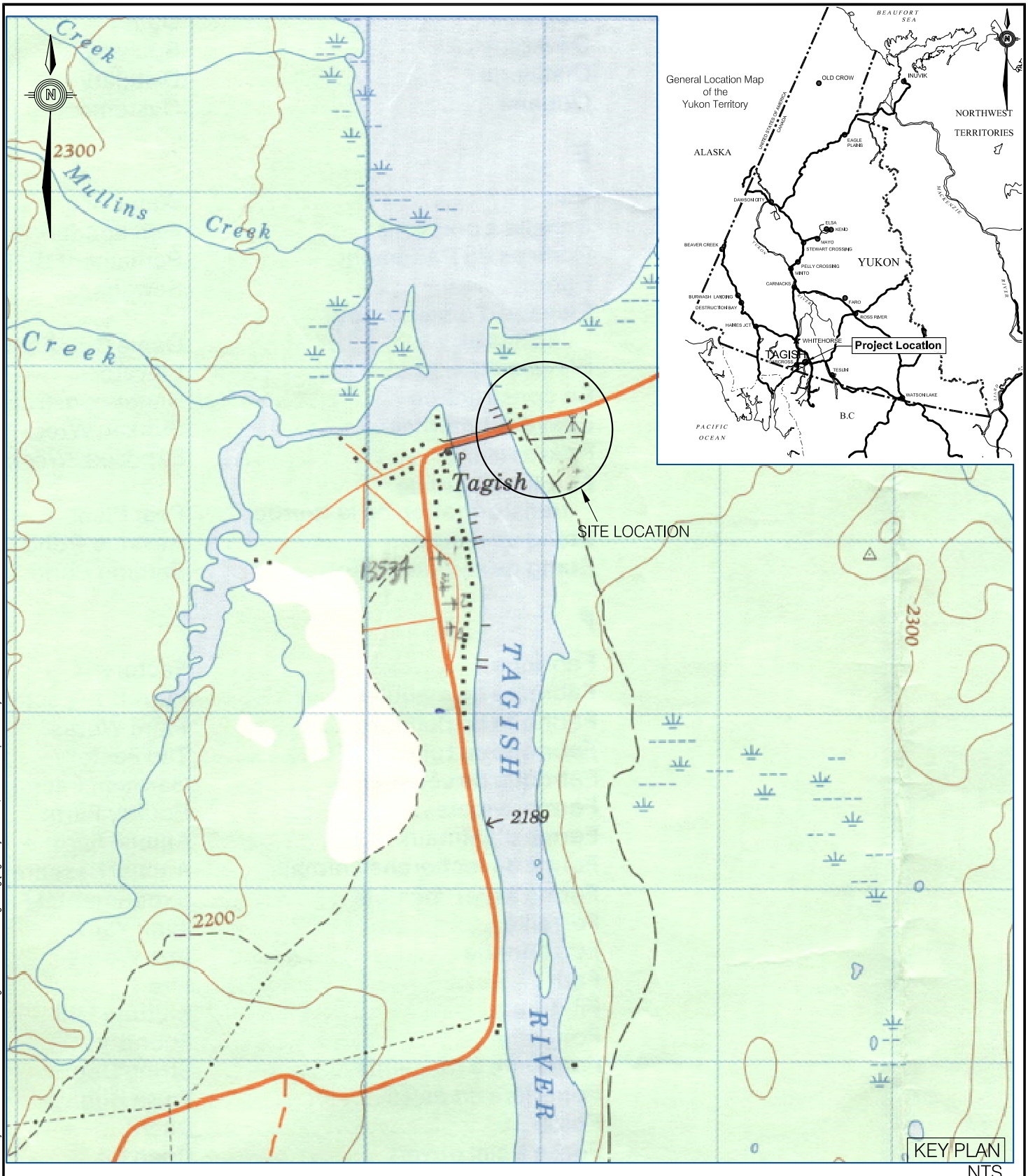
FIGURES



	CLIENT: Carcross Tagish First Nation	WATER SOURCE PROTECTION PLAN CTFN COMMUNITY WELLS NO. 2 AND 3 - TAGISH, YT SITE LOCATION MAP
EBA Engineering Consultants Ltd.	PROJECT NO. W23101256 / DWN KJT / CKD CM/RMM / REV 0 OFFICE EBA-WHSE / DATE March 3, 2010	Figure 1

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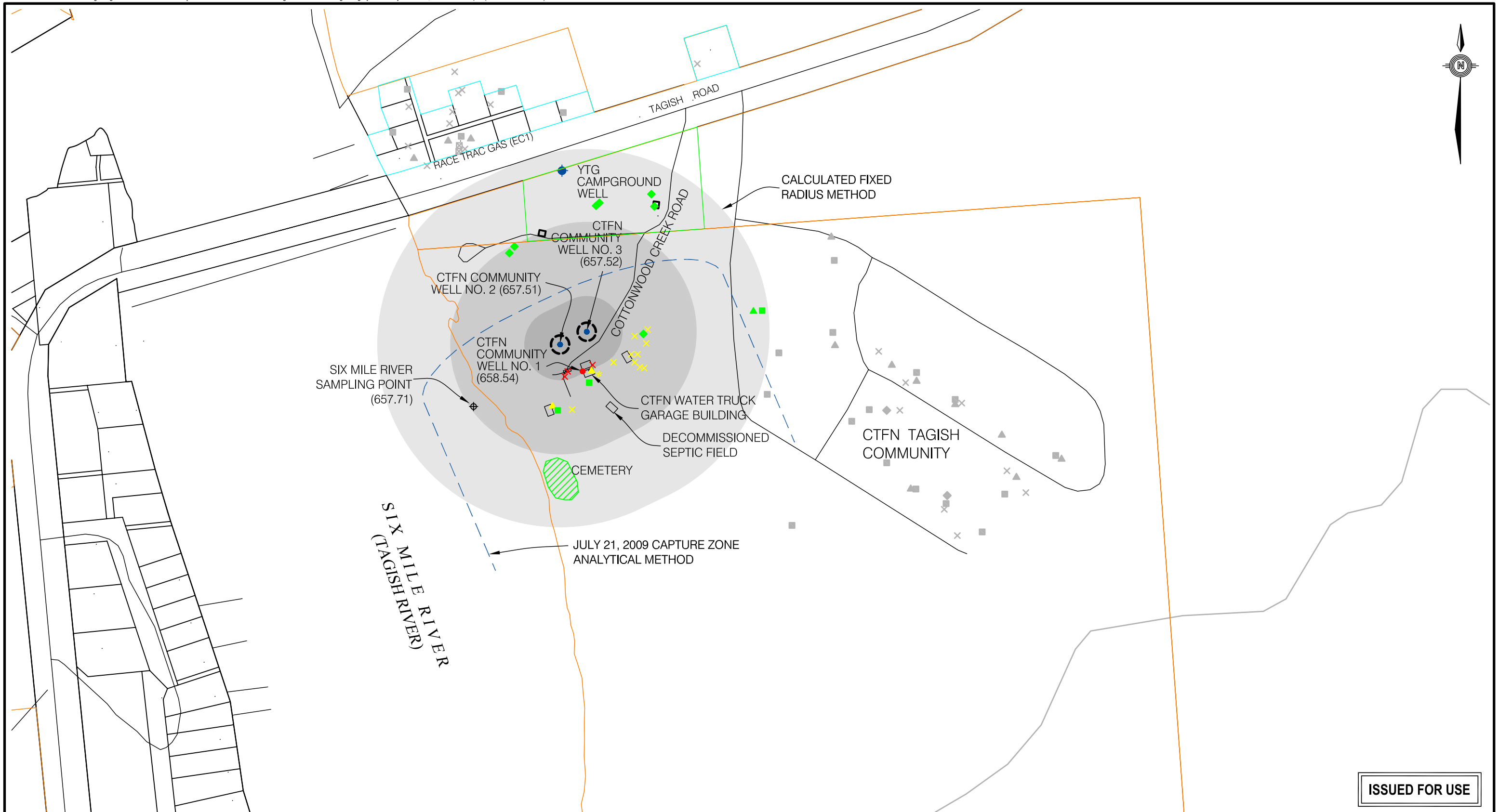


ISSUED FOR USE

LEGEND:

- CTFN COMMUNITY WELL
- YTG CAMPGROUND WELL
- SIX MILE RIVER WATER SAMPLING POINT
- PRIVATE LANDS
- CTFN LANDS
- YTG CAMPGROUND

0 250
Scale: 1: 5 000 (metres)

POTENTIAL CONTAMINANT SOURCES

NO RISK	LOW RISK	MEDIUM RISK	HIGH RISK	
×	×	×	×	HOUSEHOLD WASTE, INCLUDING OLD CAR PARTS, OLD BARRELS, ETC.
■	■	■	■	SEWAGE HOLDING TANK
▲	▲	▲	▲	ABOVE GROUND FUEL STORAGE TANK (AST)
◆	◆	◆	◆	OUTHOUSE
⊠	⊠	⊠	⊠	UNDERGROUND FUEL STORAGE TANK(UST)
*	*	*	*	ROCK PIT

- 90 DAY SANITARY ZONE
- 1 - YEAR HORIZONTAL TRAVEL TIME ZONE
- 5 - YEAR HORIZONTAL TRAVEL TIME ZONE
- 10 - YEAR HORIZONTAL TRAVEL TIME ZONE
- (657.51) RELATIVE GROUNDWATER/WATER ELEVATION (m-asl)

CLIENT
Carcross Tagish First Nation

WATER SOURCE PROTECTION PLAN TAGISH WELLS NO. 2 AND 3, TAGISH , YUKON

THEORETICAL WELL CAPTURE ZONES - RISK MAP

EBA Engineering Consultants Ltd.

PROJECT NO.	DWN	CKD	REV
W23101256	KJT	CM	0
OFFICE: EBA-WHSE	DATE: March 29, 2010		

Figure 2

TABLES

TABLE 1: WELL CONSTRUCTION DETAILS FOR WATER WELLS IN THE CTFN TAGISH COMMUNITY AREA

Well Identification	Location Description	GPS UTM Coordinates (Zone 8)		Relative Grade Elevation (+/- 5 cm) (m-asl)	Well Details								Groundwater Quality	Current Condition
		Northing (+/- 7 m)	Easting (+/- 7 m)		Well Casing Diameter (mm)	Year Well Completed	Well Log?	Well Depth (m-bgs)	Reported Low Permeability Protective Layer?	Well Screen Slot Size and Length	Well Capacity - Tested or Reported by Driller	Static Water Level Below Ground Surface on July 21, 2009		
CTFN Community Well No. 1	Inside the water truck garage building which houses the water delivery truck, water tanks, distribution system and water treatment equipment.	6686624	540960	660.55	152	Unknown	no	25.6 (EBA, 2004)	unknown	Down-hole video inspection in 2003 confirmed that no screen was installed	Unknown	2.01 m	dissolved Mn > AO (reported)	Not in use
CTFN Community Well No. 2	In a pump house, approximately 150 m from Six Mile River	6686659	540928	659.98	203	2003	yes	63	clay from surface to 30.3 m-bgs and till from 45.8 m to 51.8 m-bgs (confined)	2.4 m long 0.254 mm (0.010") slot screen set between 57.9 m and 60.3 m-bgs	0.88 L/s (tested)	2.48 m	total As > MAC and total Mn > AO (Exova July 2009 lab report)	Currently in Use
CTFN Community Well No. 3	In a wooden box, approximately 185 m from Six Mile River	6686677	540964	660.00	203	2004	yes	51	clay from 0.6 m to 22.6 m-bgs; from 36.3 m to 39.3 m-bgs; from 46.0 m to 49.7 m-bgs	1.2 m long 0.508 mm (0.020") slot screen set between 49.7 m and 51.2 m-bgs	1.03 L/s (tested)	2.58 m	total As > AO and total Fe and total Mn > AO (Exova July 2009 lab report)	Currently in Use
Campground Well	Campground (north end of the campground site)	N/A	N/A	N/A	152	1987	no	105	clay with silt and till layer from surface ground to 103.6 m-bgs (confined)	0.457 mm (0.018") (of unknown length)	4 US(?) gpm (reported by driller)	N/A	As > MAC (reported)	Not in use

Notes:

1. Information obtained from driller's well records and/or previous hydrogeological reports.
2. GPS coordinates for CTFN Community Wells No. 1, 2 and 3 were collected by EBA personnel on July 21, 2009. GPS coordinates for the Campground Well were not available.
3. Grade elevations for CTFN community wells were calculated relative to an assumed geodetic grade elevation of 660 m-asl at CTFN Community Well No. 3. The wells were surveyed by EBA on July 21, 2009.
4. Groundwater Quality parameters were compared to the Guidelines for Canadian Drinking Water Quality (GCDWQ, 2008).
   - GCDWQ Maximum Allowable Concentration (MAC) for arsenic (As) is 0.01 mg/L.
   - GCDWQ Aesthetic Objective (AO) for iron (Fe) is 0.3 mg/L.
   - GCDWQ AO for manganese (Mn) is 0.05 mg/L.

N/A indicates "data not available."
m-asl indicates "metres above sea level."
m-bgs indicates "metres below ground surface."
USgpm indicates "US gallons per minute."
L/s indicates "litres per second."

TABLE 2A: AQUIFER VULNERABILITY - INTRINSIC SUSCEPTIBILITY INDEX FOR CTFN COMMUNITY WELL NO. 2

Interval		Effective Thickness (a)	Description	K factor (b)	(a*b)
from	to				
0.00	30.5	30.5	CLAY, some silt	8	244
30.5	38.0	7.50	GRAVEL, trace to some silt and clay	1	8
38.0	41.0	3.00	gravel TILL, sandy, silty, trace to some clay	1	3
41.0	43.8	2.80	SAND and GRAVEL	1	3
43.8	45.8	1.95	SILT, sandy, trace of gravel	4	8
45.8	47.3	1.50	gravel TILL, silty, trace of clay	1	2
47.3	50.3	3.00	silt TILL, some clay, trace gravel	4	12
50.3	51.8	1.50	gravel TILL, silty	3	5
51.8	61.0	9.25	SAND, trace silt (aquifer)	2	
61.0	63.0	2.00	silt TILL	4	
					283

TABLE 2B: AQUIFER VULNERABILITY - INTRINSIC SUSCEPTIBILITY INDEX FOR CTFN COMMUNITY WELL NO. 3

Interval		Effective Thickness (a)	Description	K factor (b)	(a*b)
from	to				
0.00	0.60	0.60	TOPSOIL	1	1
0.60	4.60	4.00	CLAY, silty	8	32
4.6	22.6	18.0	CLAY	8	144
22.6	23.8	1.20	glacial TILL	5	6
23.8	24.1	0.30	GRAVEL, silty	1	0
24.1	26.2	2.10	SAND, coarse	2	4
26.2	29.6	3.40	SAND and GRAVEL	1	3
29.6	36.3	6.70	SAND, silty	2	13
36.3	39.3	3.00	CLAY, silty	8	24
39.3	40.8	1.50	GRAVEL, silty and sandy	1	2
40.8	45.7	4.90	SAND, fine, interbedded clay and till layers	2	10
45.7	46.0	0.30	GRAVEL, sandy	1	0
46.0	49.7	3.70	CLAY	8	30
49.7	51.2	1.50	SAND, coarse (aquifer)	2	
					269

Notes:

1. Intrinsic Susceptibility Index Method from Ontario Ministry of the Environment (Groundwater Studies 2001/2002 Technical Terms of References, November, 2001).
   - For confined aquifers, the ISI value is calculated by summing the product of the thickness of each geological unit encountered by the well and the corresponding K-factor, from ground surface to the top of the aquifer zone.
2. Aquifer vulnerability is low if the value is greater than 80, the vulnerability is medium is the value is between 30 and 80 and the aquifer vulnerability is high if the value is less than 30.
3. The vulnerability of the confined aquifer encountered by CTFN Community Wells No. 2 and No. 3 is low.

TABLE 5: POTENTIAL HAZARDS IN THE VICINITY OF CTFN COMMUNITY WELLS

Areas of Potential Environmental Concern (APECs)	GPS Coordinates (Zone 8)		Inside 10-Year Travel Time Zone (Yes/No)
	Northing (+/- 6m)	Easting (+/- 6 m)	
Rock Pit			
Rock pit south west of the CTFN water truck garage	-	-	Yes
Septic Systems/Holding Tanks			
Sewage Holding Tank - CTFN water truck garage	6686612	540983	Yes
Sewage Holding Tank - CTFN water truck garage	6686594	540996	Yes
Sewage Holding Tank - Residence southwest of the CTFN water truck garage.	6686582	540930	No
Sewage Holding Tank - Residential - CTFN Tagish Community (CTFN C-41B Land)	6686711	541205	No
Sewage Holding Tank - Residential - CTFN Tagish Community (CTFN C-41B Land)	6686780	541304	No
Sewage Holding Tank - Residential - CTFN Tagish Community (CTFN C-41B Land)	6686681	541302	No
Sewage Holding Tank - Residential - CTFN Tagish Community (CTFN C-41B Land)	6686575	541352	No
Sewage Holding Tank - Residential - CTFN Tagish Community (CTFN C-41B Land)	6686589	541470	No
Sewage Holding Tank - Residential - CTFN Tagish Community (CTFN C-41B Land)	6686626	541417	No
Sewage Holding Tank - Residential - CTFN Tagish Community (CTFN C-41B Land)	6686459	541538	No
Sewage Holding Tank - Residential - CTFN Tagish Community (CTFN C-41B Land)	6686512	541608	No
Sewage Holding Tank - Residential - CTFN Tagish Community (CTFN C-41B Land)	6686559	541328	No
Sewage Holding Tank - Residential - CTFN Tagish Community (CTFN C-41B Land)	6686416	541246	No
Sewage Holding Tank - Residential - CTFN Tagish Community (CTFN C-41B Land)	6686502	541376	No
Sewage Holding Tank - Residential - CTFN Tagish Community (CTFN C-41B Land)	6686466	541416	No
Sewage Holding Tank - Residential - CTFN Tagish Community (CTFN C-41B Land)	6686446	541455	No
Sewage Holding Tank - Residential - CTFN Tagish Community (CTFN C-41B Land)	6686407	541507	No
Sewage Holding Tank - Residential - CTFN Tagish Community (CTFN C-41B Land)	6686596	541212	No
Sewage Holding Tank - Residential - CTFN Tagish Community (CTFN C-41B Land)	6686653	541228	No
Sewage Holding Tank - Residential - Lot 88-1, Tagish, 66498 CLSR YT	6686983	540932	No
Sewage Holding Tank - Residential - Lot 91, Tagish, 66498 CLSR YT	6686969	540816	No
Sewage Holding Tank - Residential - Lot 94, Tagish, 66498 CLSR YT	6687012	540847	No
Sewage Holding Tank - Residential - Lot 97, Tagish, 66498 CLSR YT	6686589	540923	No
Above-Ground Storage Tanks (AST's)			
Above ground tank - heating fuel - CTFN water truck garage	6686629	540917	Yes
abandoned tank - heating fuel - former Laundromat facility	6686620	540934	Yes
Above-Ground Tank - heating fuel - Residence southwest of the Community Wells	6686580	540917	Yes
Above-Ground Tank - heating fuel - CTFN Tagish Community (CTFN C-41B Land)	6686710	541193	No
Above-Ground Tank - heating fuel - CTFN Tagish Community (CTFN C-41B Land)	6686812	541300	No
Above-Ground Tank - heating fuel - CTFN Tagish Community (CTFN C-41B Land)	6686663	541305	No
Above-Ground Tank - heating fuel - CTFN Tagish Community (CTFN C-41B Land)	6686636	541383	No
Above-Ground Tank - heating fuel - CTFN Tagish Community (CTFN C-41B Land)	6686614	541417	No
Above-Ground Tank - heating fuel - CTFN Tagish Community (CTFN C-41B Land)	6686582	541470	No
Above-Ground Tank - heating fuel - CTFN Tagish Community (CTFN C-41B Land)	6686540	541534	No
Above-Ground Tank - heating fuel - CTFN Tagish Community (CTFN C-41B Land)	6686482	541554	No
Above-Ground Tank - heating fuel - CTFN Tagish Community (CTFN C-41B Land)	6686507	541616	No
Above-Ground Tank - heating fuel - CTFN Tagish Community (CTFN C-41B Land)	6686466	541409	No
Above-Ground Tank - heating fuel - CTFN Tagish Community (CTFN C-41B Land)	6686405	541505	No
Above-Ground Tank - heating fuel - CTFN Tagish Community (CTFN C-41B Land)	6686587	540919	No
Above-Ground Tank - heating fuel - Residence on Lot 87, Tagish, 66498 CLSR YT	6686920	540727	No
Above-Ground Tank - heating fuel - Residence on Lot 89, Tagish, 66498 CLSR YT	6686991	540720	No
Above-Ground Tank - heating fuel - Shed on Lot 91, Tagish, 66498 CLSR YT	6686946	540805	No
Above-Ground Tank - heating fuel - Residence on Lot 91, Tagish, 66498 CLSR YT	6686944	540774	No
Under-Ground Storage Tanks (AST's)			
Under-Ground Tanks - gasoline & diesel - Service Station (Race Trac Gas) on Lot 91, Tagish, 66498 CLSR YT	540791	60086937	No
Cemetery			
Cemetery - Tagish Indian Cemetery	6686495	540921	Yes
Cemetery - Tagish Indian Cemetery	6686472	540923	Yes
Outhouses/Pit Privies			
Outhouse - Approximately 50 m from CTFN Community Well No.2	6686679	541042	Yes
Outhouse - CTFN Tagish Community (CTFN C-41B Land)	6686574	541376	No
Outhouse - CTFN Tagish Community (CTFN C-41B Land)	6686457	541459	No
Outhouse - Campground site	6686871	541053	Yes
Outhouse - Campground site	6686854	541057	Yes
Outhouse - Campground site	6686855	540977	Yes
Outhouse - Campground site	6686859	540979	Yes
Outhouse - Campground site	6686799	540865	Yes
Outhouse - Campground site	6686790	540858	Yes
Miscellaneous Wastes (Including Old Automobile Parts, Used Tires and Batteries, Household Wastes, etc.)			
Old automobile parts - CTFN Tagish Community (CTFN C-41B Land)	6686651	541025	Yes
Old automobile parts - CTFN Tagish Community (CTFN C-41B Land)	6687039	540783	No
Old automobile parts - CTFN Tagish Community (CTFN C-41B Land)	6686640	541030	Yes
Old automobile parts - CTFN Tagish Community (CTFN C-41B Land)	6686910	540745	No
Old automobile parts - CTFN Tagish Community (CTFN C-41B Land)	6686633	541038	Yes
Old automobile parts - CTFN Tagish Community (CTFN C-41B Land)	6686969	540815	No
Old automobile parts - CTFN Tagish Community (CTFN C-41B Land)	6686685	541048	Yes
Old automobile parts - CTFN Tagish Community (CTFN C-41B Land)	6686655	541365	No
Old automobile parts - CTFN Tagish Community (CTFN C-41B Land)	6686574	541394	No
Old automobile parts - CTFN Tagish Community (CTFN C-41B Land)	6686612	541402	No
Old automobile parts - CTFN Tagish Community (CTFN C-41B Land)	6686584	541479	No
Old automobile parts - CTFN Tagish Community (CTFN C-41B Land)	6686491	541541	No
Old automobile parts - CTFN Tagish Community (CTFN C-41B Land)	6686461	541567	No
Old automobile parts - CTFN Tagish Community (CTFN C-41B Land)	6686402	541473	No
Used tires, batteries in old barrels - outside the former water truck garage	6686636	540972	Yes
miscellaneous wastes - CTFN Tagish Community (CTFN C-41B Land)	6686676	541030	Yes
miscellaneous wastes - CTFN Tagish Community (CTFN C-41B Land)	6686933	540797	No
miscellaneous wastes - CTFN Tagish Community (CTFN C-41B Land)	6686990	540721	no
miscellaneous wastes - CTFN Tagish Community (CTFN C-41B Land)	6686575	540944	Yes
miscellaneous wastes - CTFN Tagish Community (CTFN C-41B Land)	6686640	541001	Yes
miscellaneous wastes - CTFN Tagish Community (CTFN C-41B Land)	6686937	540719	No
miscellaneous wastes - CTFN Tagish Community (CTFN C-41B Land)	6686632	541043	Yes
miscellaneous wastes - CTFN Tagish Community (CTFN C-41B Land)	6686968	540776	No
miscellaneous wastes - CTFN Tagish Community (CTFN C-41B Land)	6686651	541034	Yes
miscellaneous wastes - CTFN Tagish Community (CTFN C-41B Land)	6686984	540780	No
miscellaneous wastes - CTFN Tagish Community (CTFN C-41B Land)	6686666	541046	Yes
miscellaneous wastes - CTFN Tagish Community (CTFN C-41B Land)	6686438	541455	No
miscellaneous wastes - CTFN Tagish Community (CTFN C-41B Land)	6687010	540788	No
miscellaneous wastes - CTFN Tagish Community (CTFN C-41B Land)	6687014	540793	No
miscellaneous wastes - CTFN Tagish Community (CTFN C-41B Land)	6686994	540832	No
Existing Wells			
Well No. 1 - not in operation due to insufficient capacity.	6686624	540960	Yes
YG Campground Well - reportedly to have been decommissioned due to an elevated arsenic level.	6686903	540930	No
Yukon Government - Department of Environment (After 2001)[1]			
Tagish Dump - approximately 0.6 m east of the study area. The site was decommissioned in 1996. Details on the site location and decommissioning process not available.	6686936	546769	no
Environment Canada (Before 2001)[1]			
Tagish Marina - gasoline leakage (unknown volume) in May 1995. EC Spill Number 9511.	6696941	540675	no

Notes:

1. Spill records for incidents occurred before 2001 were obtained from the Environment of Canada and incidents occurred after 2001 were obtained from the Yukon Government's Department of Environment.
2. Areas of potential environmental concerns identified by Gardner Lee Limited on Lot 1030-1, Quad 105C/02 were unable to be reviewed by EBA.

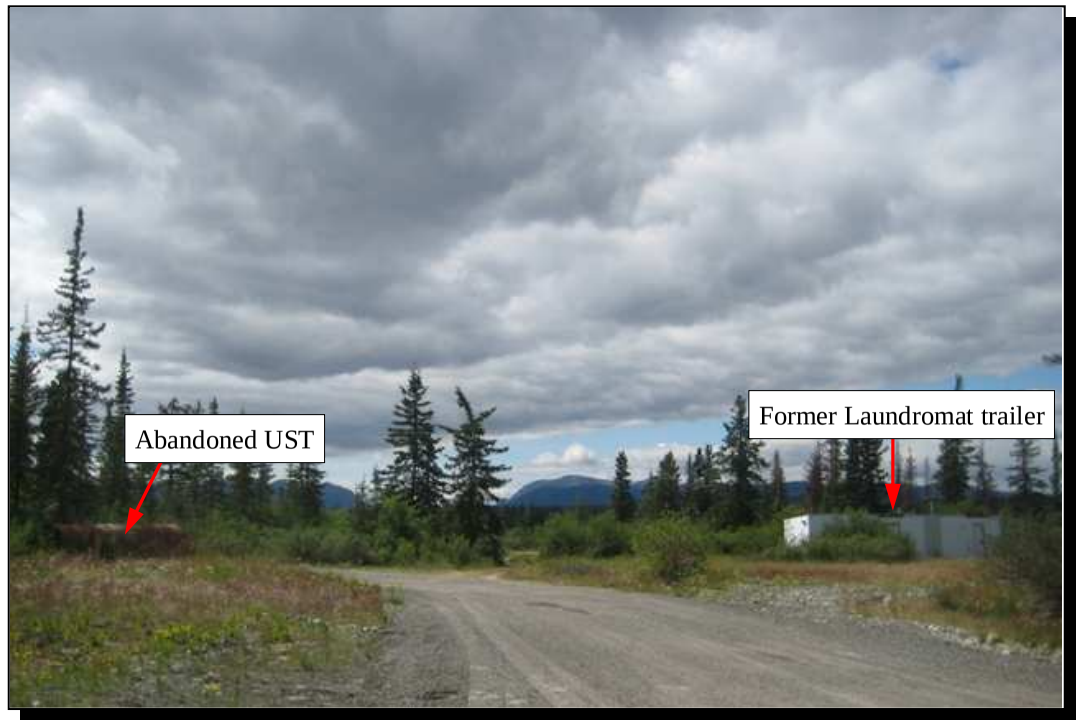
PHOTOGRAPHS

Photograph 1
View of CTFN Community Well No. 2 in pump house, looking north.

Photograph 2
View of CTFN Community Well No. 3 in a wooden enclosure, looking south. Water truck garage building and the condemned building in background.

Photograph 3
View of the unused CTFN Community Well No. 1.

Photograph 4
View of the above-ground fuel storage tank inside the CTFN water truck garage building, looking west.



Photograph 5
View of the abandoned underground fuel storage tank for the former Laundromat trailer, looking west.

Photograph 6
View of miscellaneous household wastes, including old part parts, scattered over the CTFN Tagish Community.

Photograph 7
View of the service pipe for the sewage system for the water truck garage building. CTFN Community Well No. 2 in background.

Photograph 8
First Nation cemetery site located approximately 120 m southwest of the water truck garage building.

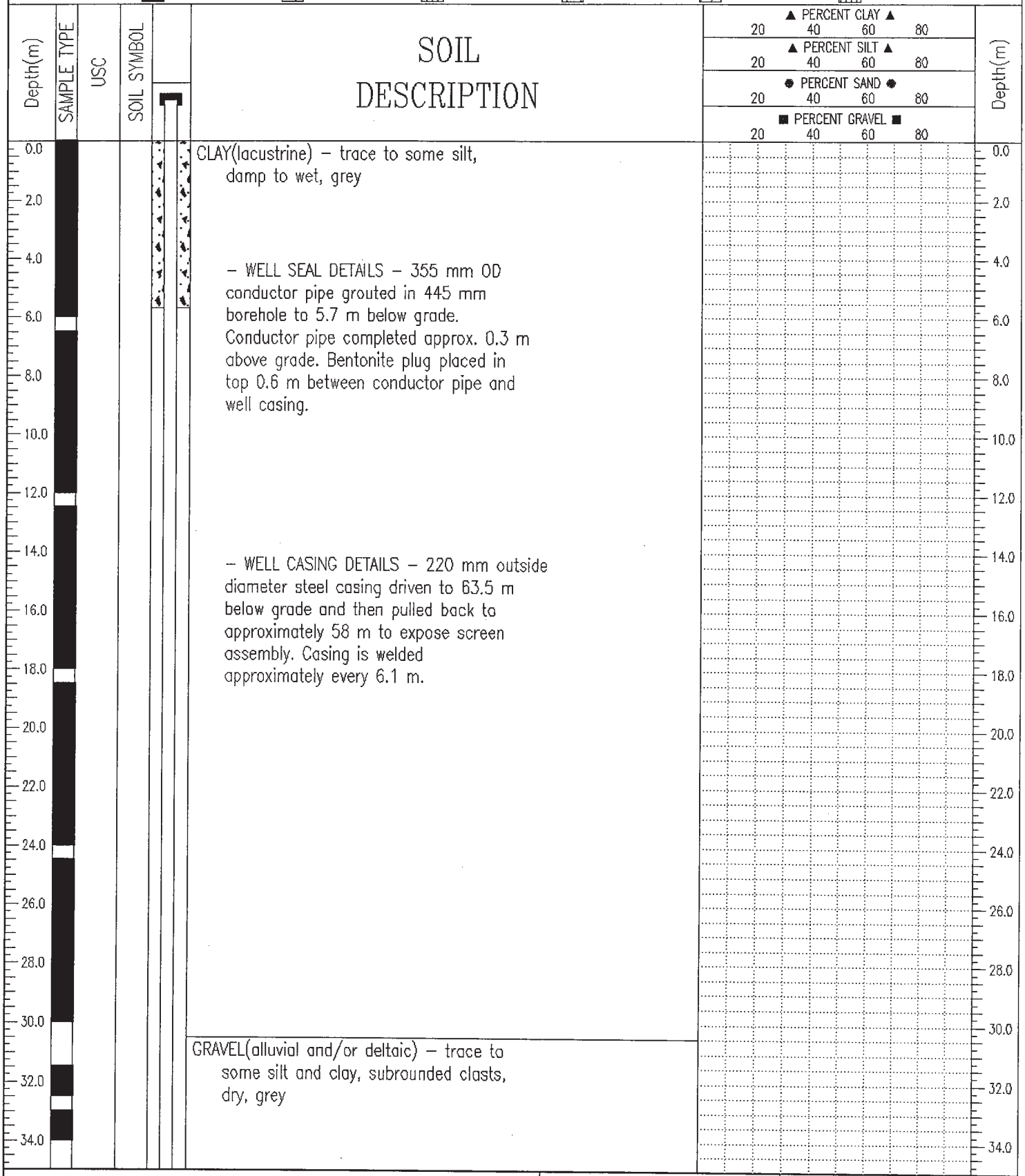
APPENDIX A

APPENDIX A CARCROSS TAGISH FIRST NATION COMMUNITY WELLS NO. 2 AND NO. 3 LOGS

Tagish Well #2	CLIENT: Carcross Tagish First Nation	BOREHOLE NO: 1240063-W2
Completion Report	DRILL: Air Rotary - ODEX	PROJECT NO: 1240063
Tagish, YT	UTM ZONE: - N6686700 E541055	ELEVATION:

SAMPLE TYPE: GRAB SAMPLE | NO RECOVERY | STANDARD PEN. | 75 mm SPLIT SP. | CRREL BARREL | NW CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND



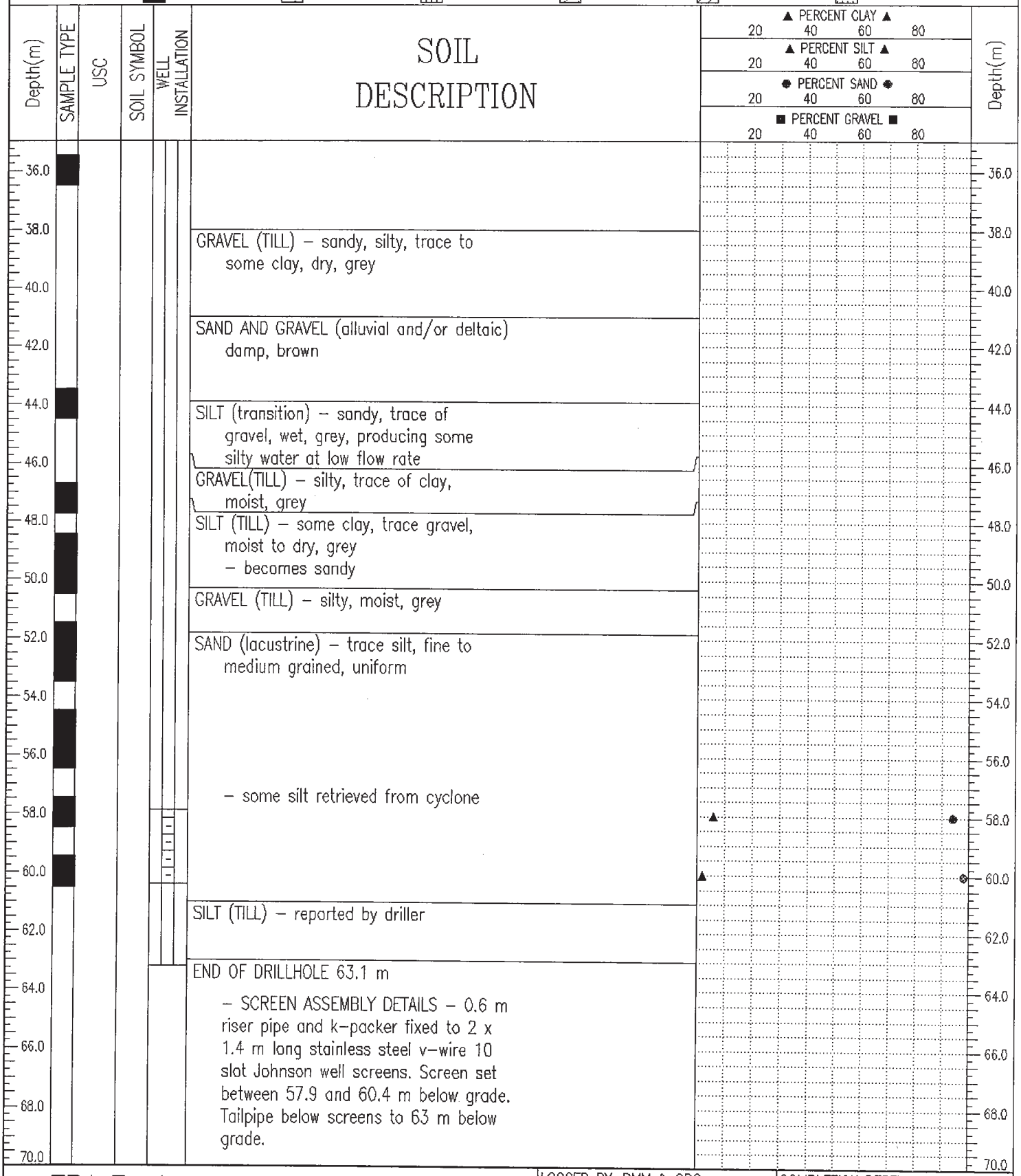
EBA Engineering Consultants Ltd. Whitehorse, Yukon	LOGGED BY: RMM & CPC	COMPLETION DEPTH: 63.1 m
	REVIEWED BY: JRT	COMPLETE: 03/10/01
		Page 1 of 2

04/01/26 03:11PM (WELL70)

Tagish Well #2	CLIENT: Carcross Tagish First Nation	BOREHOLE NO: 1240063-W2
Completion Report	DRILL: Air Rotary – ODEX	PROJECT NO: 1240063
Tagish, YT	UTM ZONE: – N6686700 E541055	ELEVATION:

SAMPLE TYPE: GRAB SAMPLE | NO RECOVERY | STANDARD PEN. | 75 mm SPLIT SP. | CRREL BARREL | NW CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND



EBA Engineering Consultants Ltd. Whitehorse, Yukon	LOGGED BY: RMM & CPC	COMPLETION DEPTH: 63.1 m
	REVIEWED BY: JRT	COMPLETE: 03/10/01
		Page 2 of 2

04/01/26 03:11PM (WELL70)

Date: Sept 4/04

Well Owner: Carcross Tagish First Nations

Address: Carcross, Yukon

Phone: _____ Fax: _____

General Information

Well Location: ☐ At owners address ☑ Other Tagish pumping station.

Water Quality: ☐ Good ☐ Poor, why _____

Water Analysis: ☐ chemical ☐ Biological ☐ none

Comments: _____

Taste: _____

Water use: ☐ domestic ☐ Stock ☐ Garden

☐ Irrigation ☐ Heat pump ☐ Industry

☐ Community supply; number of connections _____

☐ Other _____

Aquifer: ☐ Rock ☑ Sand and gravel

Well Capacity

Capacity: ☐ dry hole ☐ Inadequate

☐ Satisfactory for proposed use

Capacity test: ☐ Bail test ☐ Air lift ☐ Pump test

Length of test _____ minutes Rate: _____

Water level at start: _____

Drawdown at end: _____

Estimated well capacity: _____

Was a water sample taken at end of test? ☑ Yes ☐ No

Final well completion

Cover on casing ☑ Welded plate ☐ Pitless adaptor

☐ Aluminium cover ☐ Well seal

Casing: ☑ above ground ☐ In pit ☐ In old dug well

Is casing sealed? ☑ Yes ☐ No

If Yes, describe: _____

Is site protected from obvious hazards, ie. poor drainage, grazing animals, buried fuel tanks, etc. ☐ Yes ☐ No

If no, what can be done? _____

If well location cannot be described from a road address, please sketch approximate location on reverse side of file copy of well record or attach separate sheet.

Contractor: Cathway Water Resources

Address: _____

Phone: _____ Fax: _____

Driller: Ron Toews

Well Log Metres ☐ Feet ☑

From	To	Description
0	2	top soil
2	15	sandy clay
15	74	soupy clay
74	78	glacial till
78	79	silty gravel. w/water
79	86	cleaner sand (course)
86	87	silty gravel + course sand
99	119	course, silty sand (dry + hard)
119	129	sandy clay (sticky)
129	134	silty, sandy gravel (a little water)
134	150	fine sand w clay + till layers

* If ~~drilling is in rock~~, note depth of fractures which make water: 150-151 sandy gravel. (some water)
151-163 hard clay
163-168 - course sand w/water

Well Construction

Surface Casing: Diameter 10"

Length 20' Stick up 1'

☑ removed ☐ Left in place

Well Casing: Diameter 8"

Length 165'4" Stick up 2'

Wall thickness: .250

Casing shoe ☑ yes ☐ no

Completion: ☑ well screen ☐ slotted pipe

☐ open end ☐ other

Well screen: ☑ stainless ☐ galvanized steel

☐ plastic

from 168' to 163'4" slot width 20

from _____ to _____ slot width _____

Design based on: ☑ sieve analysis

☐ estimated slot size

Other screen data: screen has bail bottom + K-packer

Development method: ☑ surge ☑ bail ☐ air

☐ water jet ☑ pump ☐ other _____

Static water level below ground: _____

☐ flowing Rate: _____

Cathway Water Resources, Box 21048, Whitehorse, Yukon Y1A 6P6 Phone/Fax: (867) 668-7208 Home 668-1103

APPENDIX B

APPENDIX B HISTORICAL OPERATIONAL DATA

CARCROSS / TAGISH FIRST NATION
CAPITAL PROJECTS - BOX 130 CARCROSS YUKON YOB 1BO
PH (867) 821 3816 FAX (867) 821 4812

WELL #2 **TAGISH WATERSHED FLOWMETER CHART**

	WELL FLOWMETER			WELL PUMP HOURMETER				
DATE 2008	READING IN	READING OUT	TOTAL LITERS	PUMP HR IN	PUMP HR OUT	PUMP HOURS	LITERS HOUR	CURRENT AMPS
8-Jan	2657100	2659900	10612	752.2	754.7	2.5	4244.8	
11-Jan	2666100	2670700	17434	754.7	759.5	4.8	3632.083	7.23
14-Jan	2673900	2679600	21603	759.7	764.7	5	4320.6	7.29
21-Jan	2684500	2690400	22361	764.7	770.1	5.4	4140.926	7.23
25-Jan	2695300	2699300	15160	770.1	773.9	3.8	3989.474	7.32
29-Jan	2701300	2705300	15160	773.9	777.9	4	3790	7.57
**Flowmeter values in U.S. Gallons								

CARCROSS / TAGISH FIRST NATION
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WELL #2 **TAGISH WATERSHED FLOWMETER CHART**

	WELL FLOWMETER			WELL PUMP HOURMETER				
DATE 2008	READING IN	READING OUT	TOTAL LITERS	PUMP HR IN	PUMP HR OUT	PUMP HOURS	LITERS HOUR	CURRENT AMPS
4-Feb	2710800	2721200	39416	777.9	788.4	10.5	3753.905	7.15
11-Feb	2725400	2733900	32215	788.4	796.5	8.1	3977.16	6.96
18-Feb	2737800	2744700	26151	796.5	803.3	6.8	3845.735	7.2
21-Feb	2749100	2754300	19708	804.1	808.5	4.4	4479.091	7.1
28-Feb	2758100	2763500	20466	808.7	813.7	5	4093.2	7.29
**Flowmeter values in U.S. Gallons								

CARCROSS / TAGISH FIRST NATION
CAPITAL PROJECTS - BOX 130 CARCROSS YUKON YOB 1BO
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WELL #2 **TAGISH WATERSHED FLOWMETER CHART**

	WELL FLOWMETER			WELL PUMP HOURMETER				
DATE 2008	READING IN	READING OUT	TOTAL LITERS	PUMP HR IN	PUMP HR OUT	PUMP HOURS	LITERS HOUR	CURRENT AMPS
3-Mar	2767700	2772200	17055	813.7	817.6	3.9	4373.077	7.31
6-Mar	2776500	2777700	4548	817.6	818.7	1.1	4134.545	7.2
12-Mar	2787200	2793800	25014	819.9	825.6	5.7	4388.421	7.39
19-Mar	2797200	2840900	165623	825.6	831.6	6	27603.83	7.29
25-Mar	2809600	2811600	7580	831.6	833.6	2	3790	7.31
27-Mar	2814400	2823500	34489	833.6	841.2	7.6	4538.026	7.31
**Flowmeter values in U.S. Gallons								

hju

CARCROSS / TAGISH FIRST NATION
CAPITAL PROJECTS - BOX 130 CARCROSS YUKON YOB 1BO
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WELL #2 TAGISH WATERSHED FLOWMETER CHART

	WELL FLOWMETER			WELL PUMP HOURMETER				
DATE 2008	READING IN	READING OUT	TOTAL LITERS	PUMP HR IN	PUMP HR OUT	PUMP HOURS	LITERS HOUR	CURRENT AMPS
4-Apr	2826000	2831600	21224	841.2	846.2	5	4244.8	7.01
8-Apr	2835300	2836500	4548	846.2	847.2	1	4548	7.2
9-Apr	2838400	2840800	9096	847.2	849.6	2.4	3790	7.18
11-Apr	2843300	2847300	15160	849.6	852.8	3.2	4737.5	7.19
16-Apr	2849600	2853300	14023	853	855.9	2.9	4835.517	7.17
21-Apr	2857800	2862700	18571	855.9	859.9	4	4642.75	7.07
24-Apr	2867200	2869800	9854	859.9	862.5	2.6	3790	6.8
25-Apr	2871800	2877400	21224	862.5	867.7	5.2	4081.538	7.29

**Flowmeter values in U.S. Gallons

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WELL #2 **TAGISH WATERSHED FLOWMETER CHART**

	WELL FLOWMETER			WELL PUMP HOURMETER				
DATE 2008	READING IN	READING OUT	TOTAL LITERS	PUMP HR IN	PUMP HR OUT	PUMP HOURS	LITERS HOUR	CURRENT AMPS
1-May	2886600	2891300	17813	867.7	871.3	3.6	4948.056	7.23
5-May	2896600	2903800	27288	871.3	877.3	6	4548	7.28
7-May	2906000	2908900	10991	877.3	879.6	2.3	4778.696	7.08
9-May	2908900	2914300	20466	879.6	884.4	4.8	4263.75	7.21
13-May	2917600	2919600	7580	884.4	886.4	2	3790	7.29
14-May	2921500	2931900	39416	886.4	895.4	9	4379.556	7.31
21-May	2934400	2946400	45480	895.4	905.9	10.5	4331.429	7.21
28-May	2949600	2954300	17813	905.9	909.9	4	4453.25	6.99
30-May	2956200	2961500	20087	909.9	914.4	4.5	4463.778	7.2
**Flowmeter values in U.S. Gallons								

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WELL #2 **TAGISH WATERSHED FLOWMETER CHART**

	WELL FLOWMETER			WELL PUMP HOURMETER				
DATE 2008	READING IN	READING OUT	TOTAL LITERS	PUMP HR IN	PUMP HR OUT	PUMP HOURS	LITERS HOUR	CURRENT AMPS
3-Jun	2964200	2964700	1895	914.4	915	0.6	3158.333	7.06
26-Jun	3011500	3017200	21603	964.9	980.5	15.6	1384.808	
27-Jun	3017200	3021000	14402	980.5	984.2	3.7	3892.432	6.73
30-Jun	3021000	3027500	24635	984.2	989.4	5.2	4737.5	6.85
**Flowmeter values in U.S. Gallons								

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WELL #2 **TAGISH WATERSHED FLOWMETER CHART**

	WELL FLOWMETER			WELL PUMP HOURMETER				
DATE 2008	READING IN	READING OUT	TOTAL LITERS	PUMP HR IN	PUMP HR OUT	PUMP HOURS	LITERS HOUR	CURRENT AMPS
3-Jul	3030100	3039000	33731	989.4	998.6	9.2	3666.413	6.73
8-Jul	3042900	3050200	27667	998.6	1006.8	8.2	3374.024	6.92
15-Jul	3053000	3055800	10612	1006.8	1008.9	2.1	5053.333	6.64
18-Jul	3057700	3064400	25393	1008.9	1015	6.1	4162.787	6.77
24-Jul	3070100	3075900	21982	1015	1022	7	3140.286	6.81
30-Jul	3079400	3084600	19708	1022	1026.8	4.8	4105.833	5.22
**Flowmeter values in U.S. Gallons								

CARCROSS / TAGISH FIRST NATION
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WELL #2 **TAGISH WATERSHED FLOWMETER CHART**

	WELL FLOWMETER			WELL PUMP HOURMETER				
DATE 2008	READING IN	READING OUT	TOTAL LITERS	PUMP HR IN	PUMP HR OUT	PUMP HOURS	LITERS HOUR	CURRENT AMPS
4-Aug	3089900	3095700	21982	1026.8	1032.4	5.6	3925.357	6.79
8-Aug	3099000	3101900	10991	1033.1	1035.3	2.2	4995.909	7.14
14-Aug	3105800	3114500	32973	1035.7	1043	7.3	4516.849	6.78
21-Aug	3120700	3130300	36384	1043	1052	9	4042.667	6.77
29-Aug	3134200	3140800	25014	1055.6	1056.8	1.2	20845	6.9

**Flowmeter values in U.S. Gallons

CARCROSS / TAGISH FIRST NATION
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WELL #2 **TAGISH WATERSHED FLOWMETER CHART**

	WELL FLOWMETER			WELL PUMP HOURMETER				
DATE 2008	READING IN	READING OUT	TOTAL LITERS	PUMP HR IN	PUMP HR OUT	PUMP HOURS	LITERS HOUR	CURRENT AMPS
3-Sep	3140800	3150100	35247	1058.6	1064	5.4	6527.222	6.74
**Flowmeter values in U.S. Gallons								

CARCROSS / TAGISH FIRST NATION
CAPITAL PROJECTS - BOX 130 CARCROSS YUKON YOB 1BO
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WELL #2 **TAGISH WATERSHED FLOWMETER CHART**

	WELL FLOWMETER			WELL PUMP HOURMETER				
DATE 2008	READING IN	READING OUT	TOTAL LITERS	PUMP HR IN	PUMP HR OUT	PUMP HOURS	LITERS HOUR	CURRENT AMPS
8-Oct	3218500	3221300	10612	1070.6	1073.3	2.7	3930.37	6.77
9-Oct	3221300	3223000	6443	1073.3	1074.8	1.5	4295.333	6.6
14-Oct	3223000	3230100	26909	1074.8	1078	3.2	8409.062	6.87
15-Oct	3230100	3233400	12507	1078	1081.4	3.4	3678.529	6.55
20-Oct	3237800	3241300	13265	1081.4	1084.7	3.3	4019.697	6.47
24-Oct	3243200	3249100	22361	1084.7	1090.2	5.5	4065.636	6.64
28-Oct	3253900	3256700	10612	1090.2	1093.4	3.2	3316.25	6.66
31-Oct	3262400	3265700	12507	1093.4	1096.8	3.4	3678.529	6.53
**Flowmeter values in U.S. Gallons								

CARCROSS / TAGISH FIRST NATION
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WELL #2 **TAGISH WATERSHED FLOWMETER CHART**

	WELL FLOWMETER			WELL PUMP HOURMETER				
DATE 2008	READING IN	READING OUT	TOTAL LITERS	PUMP HR IN	PUMP HR OUT	PUMP HOURS	LITERS HOUR	CURRENT AMPS
5-Nov	3270000	3275200	19708	1096.8	1102.6	5.8	3397.931	6.52
14-Nov	3291200	3295900	17813	1102.7	1107.2	4.5	3958.444	6.85
18-Nov	3200200	3202700	9475	1107.2	1109.6	2.4	3947.917	6.63
24-Nov	3306500	3312500	22740	1109.6	1115.8	6.2	3667.742	7.33
26-Nov	3313600	3318400	18192	1115.8	1121.2	5.4	3368.889	8.04
**Flowmeter values in U.S. Gallons								

CARCROSS / TAGISH FIRST NATION
CAPITAL PROJECTS - BOX 130 CARCROSS YUKON YOB 1BO
PH (867) 821 3816 FAX (867) 821 4812

WELL #2 **TAGISH WATERSHED FLOWMETER CHART**

	WELL FLOWMETER			WELL PUMP HOURMETER				
DATE 2008	READING IN	READING OUT	TOTAL LITERS	PUMP HR IN	PUMP HR OUT	PUMP HOURS	LITERS HOUR	CURRENT AMPS
1-Dec	3323100	3326600	13265	1121.2	1125.1	3.9	3401.282	6.67
5-Dec	3331200	3335100	14781	1125.1	1129.9	4.8	3079.375	7.52
11-Dec	3338300	3346600	31457	1129.9	1137.7	7.8	4032.949	7.13
16-Dec	3350900	3354000	11749	1137.7	1140.7	3	3916.333	6.72
**Flowmeter values in U.S. Gallons								

CARCROSS / TAGISH FIRST NATION
CAPITAL PROJECTS - BOX 130 CARCROSS YUKON YOB 1BO
PH (867) 821 3816 FAX (867) 821 4812

WELL #2 **TAGISH WATERSHED FLOWMETER CHART**

	WELL FLOWMETER		WELL PUMP HOURMETER					
DATE 2009	READING IN	READING OUT	TOTAL LITERS	PUMP HR IN	PUMP HR OUT	PUMP HOURS	LITERS HOUR	CURRENT AMPS
2-Jan	3390800	3395600	18192	1164.2	1169.1	4.9	3712.653	
`6-Jan	3399900	3403500	13644	1169.1	1172.9	3.8	3590.526	7.49
8-Jan	3406000	3412900	26151	1172.9	1180.2	7.3	3582.329	7.55
15-Jan	3414700	3418700	15160	1118.2	1184.7	66.5	227.9699	6.89
19-Jan	3418700	3426200	28425	1184.7	1192.2	7.5	3790	6.7
20-Jan	3427300	3428200	3411	1192.2	1193	0.8	4263.75	6.77
21-Jan	3428200	3436400	31078	1193	1201.3	8.3	3744.337	6.93
28-Jan	3438200	3438500	1137	1201.3	1201.6	0.3	3790	6.65
29-Jan	3439500	3444700	19708	1201.6	1207.5	5.9	3340.339	8

**Flowmeter values in U.S. Gallons

CARCROSS / TAGISH FIRST NATION
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PH (867) 821 3816 FAX (867) 821 4812

WELL #2 **TAGISH WATERSHED FLOWMETER CHART**

	WELL FLOWMETER			WELL PUMP HOURMETER				
DATE 2009	READING IN	READING OUT	TOTAL LITERS	PUMP HR IN	PUMP HR OUT	PUMP HOURS	LITERS HOUR	CURRENT AMPS
3-Feb	3449100	3459400	39037	1207.5	1219	11.5	3394.522	6.93
6-Feb	3463300	3467100	14402	1219	1223.7	4.7	3064.255	6.66
11-Feb	3470300	3476300	22740	1223.7	1230.2	6.5	3498.462	7.64
16-Feb	3479400	3484600	19708	1230.2	1237.1	6.9	2856.232	6.77

**Flowmeter values in U.S. Gallons

CARCROSS / TAGISH FIRST NATION
CAPITAL PROJECTS - BOX 130 CARCROSS YUKON YOB 1BO
PH (867) 821 3816 FAX (867) 821 4812

WELL #3 TAGISH WATERSHED FLOWMETER CHART

	WELL FLOWMETER			WELL PUMP HOURMETER				
DATE 2008	READING IN	READING OUT	TOTAL LITERS	PUMP HR IN	PUMP HR OUT	PUMP HOURS	LITERS HOUR	CURRENT AMPS
2-Jan	2643400	2644900	5685	630.4	632.3	1.9	2992.105	
4-Jan	2644900	2647300	9096	632.3	635	2.7	3368.889	
5-Jan	2647300	2657100	37142	635	641.7	6.7	5543.582	
9-Jan	2659900	2666100	23498	641.8	650.6	8.8	2670.227	7.03
14-Jan	2670700	2673900	12128	650.6	654.9	4.3	2820.465	6.99
17-Jan	2679600	2684500	18571	654.9	661.8	6.9	2691.449	7.1
22-Jan	2690400	2695300	18571	662.1	668.8	6.7	2771.791	7.04
28-Jan	2699300	2701300	7580	668.8	671.1	2.3	3295.652	7.11
31-Jan	2705300	2710800	20845	671.1	678.4	7.3	2855.479	6.58

CARCROSS / TAGISH FIRST NATION
CAPITAL PROJECTS - BOX 130 CARCROSS YUKON YOB 1BO
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WELL #3 **TAGISH WATERSHED FLOWMETER CHART**

	WELL FLOWMETER			WELL PUMP HOURMETER				
DATE 2008	READING IN	READING OUT	TOTAL LITERS	PUMP HR IN	PUMP HR OUT	PUMP HOURS	LITERS HOUR	CURRENT AMPS
8-Feb	2721200	2725400	15918	678.4	684	5.6	2842.5	7.01
14-Feb	2733900	2737800	14781	684.2	689.2	5	2956.2	7.04
19-Feb	2744700	2749100	16676	689.2	693.8	4.6	3625.217	7.1
20-Feb	2754300	2758100	14402	693.8	698.5	4.7	3064.255	6.98
29-Feb	2763500	2767700	15918	698.5	703.5	5	3183.6	7.16

CARCROSS / TAGISH FIRST NATION
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WELL #3 TAGISH WATERSHED FLOWMETER CHART

	WELL FLOWMETER		WELL PUMP HOURMETER					
DATE 2008	READING IN	READING OUT	TOTAL LITERS	PUMP HR IN	PUMP HR OUT	PUMP HOURS	LITERS HOUR	CURRENT AMPS
5-Mar	2772200	2776500	16297	703.5	708.5	5	3259.4	7.43
7-Mar	2777700	2787200	36005	708.5	718.2	9.7	3711.856	7.11
17-Mar	2793800	2797200	12886	718.2	721.9	3.7	3482.703	7.24
21-Mar	2809000	2840900	120901	721.9	728.6	6.7	18044.93	7.16
26-Mar	2811600	2814400	10612	728.8	732.2	3.4	3121.176	7.18

CARCROSS / TAGISH FIRST NATION
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WELL #3 **TAGISH WATERSHED FLOWMETER CHART**

	WELL FLOWMETER			WELL PUMP HOURMETER				
DATE 2008	READING IN	READING OUT	TOTAL LITERS	PUMP HR IN	PUMP HR OUT	PUMP HOURS	LITERS HOUR	CURRENT AMPS
3-Apr	2823500	2826000	9475	732.2	734.8	2.6	3644.231	7.23
7-Apr	2831600	2835300	14023	734.8	739.5	4.7	2983.617	7.22
8-Apr	2836500	2838400	7201	739.5	741.7	2.2	3273.182	7.14
10-Apr	2840800	2843300	9475	741.7	744.4	2.7	3509.259	7.19
14-Apr	2847300	2849600	8717	744.4	747.2	2.8	3113.214	7.16
18-Apr	2853300	2857800	17055	747.2	752.5	5.3	3217.925	7.08
23-Apr	2862700	2867200	17055	752.5	758.7	6.2	2750.806	7.05
25-Apr	2869800	2871800	7580	758.7	760.9	2.2	3445.455	7.18
28-Apr	2877400	2886800	35626	760.9	772	11.1	3209.55	7.24

CARCROSS / TAGISH FIRST NATION
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WELL #3 **TAGISH WATERSHED FLOWMETER CHART**

	WELL FLOWMETER			WELL PUMP HOURMETER				
DATE 2008	READING IN	READING OUT	TOTAL LITERS	PUMP HR IN	PUMP HR OUT	PUMP HOURS	LITERS HOUR	CURRENT AMPS
2-May	2891300	2896600	20087	772	778.6	6.6	3043.485	7.11
6-May	2903800	2906000	8338	778.6	781.3	2.7	3088.148	7.14
12-May	2914300	2917600	12507	781.3	785.1	3.8	3291.316	7.21
14-May	2919600	2921500	7201	785.1	787.2	2.1	3429.048	7.26
20-May	2931900	2934400	9475	787.2	790.4	3.2	2960.938	7.05
26-May	2946400	2949600	12128	790.4	794.6	4.2	2887.619	7.07
29-May	2954300	2956200	7201	794.6	797.2	2.6	2769.615	7.28

CARCROSS / TAGISH FIRST NATION
CAPITAL PROJECTS - BOX 130 CARCROSS YUKON YOB 1BO
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WELL #3 **TAGISH WATERSHED FLOWMETER CHART**

	WELL FLOWMETER			WELL PUMP HOURMETER				
DATE 2008	READING IN	READING OUT	TOTAL LITERS	PUMP HR IN	PUMP HR OUT	PUMP HOURS	LITERS HOUR	CURRENT AMPS
3-Jun	2961500	2964200	10233	797.2	800.3	3.1	3300.968	7.11
4-Jun	2964700	2973800	34489	800.5	811.1	10.6	3253.679	7.15
6-Jun	2973800	2978900	19329	811.1	817.4	6.3	3068.095	7.05
10-Jun	2979000	2986400	28046	817.6	826.8	9.2	3048.478	7.08
12-Jun	2986400	2987600	4548	826.8	831.9	5.1	891.7647	
16-Jun	2987600	2994900	27667	831.9	842.8	10.9	2538.257	7.09
17-Jun	2994900	2997200	8717	842.8	845.9	3.1	2811.935	7.12
18-Jun	2997200	3003900	25393	845.9	855.2	9.3	2730.43	7.1
23-Jun	3003900	3007400	13265	855.2	859	3.8	3490.789	7.18
24-Jun	3007400	3009800	9096	859	861.8	2.8	3248.571	7.21
25-Jun	3009800	3011500	6443	861.8	870.9	9.1	708.022	7.42

CARCROSS / TAGISH FIRST NATION
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WELL #3 **TAGISH WATERSHED FLOWMETER CHART**

	WELL FLOWMETER		WELL PUMP HOURMETER					
DATE 2008	READING IN	READING OUT	TOTAL LITERS	PUMP HR IN	PUMP HR OUT	PUMP HOURS	LITERS HOUR	CURRENT AMPS
2-Jul	3027500	3030100	9854	870.9	874	3.1	3178.71	7.18
14-Jul	3053000	5050200	7569388	878.4	881.5	3.1	2441738	7.33
17-Jul	3055800	3057700	7201	881.6	883.8	2.2	3273.182	7.31
23-Jul	3064400	3070100	21603	883.8	890.1	6.3	3429.048	7.17
29-Jul	3075900	3079400	13265	890.1	893.9	3.8	3490.789	7.34

CARCROSS / TAGISH FIRST NATION
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WELL #3 **TAGISH WATERSHED FLOWMETER CHART**

	WELL FLOWMETER			WELL PUMP HOURMETER				
DATE 2008	READING IN	READING OUT	TOTAL LITERS	PUMP HR IN	PUMP HR OUT	PUMP HOURS	LITERS HOUR	CURRENT AMPS
1-Aug	3084600	3089900	20087	893.9	899.8	5.9	3404.576	7.19
6-Aug	3095700	3099000	12507	899.8	902.5	2.7	4632.222	7.23
11-Aug	3101900	3105800	14781	902.5	906.7	4.2	3519.286	7.24
19-Aug	3114500	3120700	23498	906.7	913.1	6.4	3671.563	7.29
25-Aug	3130300	3134200	14781	913.1	914.7	1.6	9238.125	7.1

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WELL #3 **TAGISH WATERSHED FLOWMETER CHART**

	WELL FLOWMETER			WELL PUMP HOURMETER				
DATE 2008	READING IN	READING OUT	TOTAL LITERS	PUMP HR IN	PUMP HR OUT	PUMP HOURS	LITERS HOUR	CURRENT AMPS
2-Sep	3140800	3144100	12507	920.4	924.6	4.2	2977.857	
5-Sep	3150100	3155500	20466	924.6	930.6	6	3411	6.93
10-Sep	3159300	3160600	4927	935.2	936.9	1.7	2898.235	7.19
11-Sep	3160600	3164500	14781	936.9	942.3	5.4	2737.222	7.23
12-Sep	3164500	3167600	11749	942.3	947.2	4.9	2397.755	6.98
15-Sep	3167600	3170800	12128	942.3	952.1	9.8	1237.551	6.81
17-Sep	3170800	3174000	12128	952.1	955.7	3.6	3368.889	7.17
19-Sep	3174000	3179500	20845	955.7	962.3	6.6	3158.333	7.09
22-Sep	3179500	3181500	7580	962.3	964.8	2.5	3032	7
24-Sep	3181500	3191200	36763	964.8	976.5	11.7	3142.137	7.02
26-Sep	3191200	3195600	16676	976.5	981.9	5.4	3088.148	7.12
29-Sep	3195600	3199300	14023	981.9	986.3	4.4	3187.045	6.95
30-Sep	3199300	3202200	10991	986.3	989.9	3.6	3053.056	6.92

CARCROSS / TAGISH FIRST NATION
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WELL #3 **TAGISH WATERSHED FLOWMETER CHART**

	WELL FLOWMETER			WELL PUMP HOURMETER				
DATE 2008	READING IN	READING OUT	TOTAL LITERS	PUMP HR IN	PUMP HR OUT	PUMP HOURS	LITERS HOUR	CURRENT AMPS
1-Oct	3202200	3207100	18571	989.9	995.9	6	3095.167	7.03
2-Oct	3207100	3209300	8338	995.9	998.4	2.5	3335.2	7.3
3-Oct	3209300	3212000	10233	998.4	1001.8	3.4	3009.706	7.2
6-Oct	3212000	3218500	24635	1001.8	1009.4	7.6	3241.447	7.11
10-Oct	3223000	3227100	15539	1009.4	1014	4.6	3378.043	7.12
17-Oct	3233400	3237800	16676	1014	1019.1	5.1	3269.804	7.83
22-Oct	3241300	3243200	7201	1019.1	1021.6	2.5	2880.4	7.17
27-Oct	3249100	3253900	18192	1021.6	1027.6	6	3032	7.75
29-Oct	3256700	3262400	21603	1027.6	1034.4	6.8	3176.912	7.33

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WELL #3 **TAGISH WATERSHED FLOWMETER CHART**

	WELL FLOWMETER			WELL PUMP HOURMETER				
DATE 2008	READING IN	READING OUT	TOTAL LITERS	PUMP HR IN	PUMP HR OUT	PUMP HOURS	LITERS HOUR	CURRENT AMPS
3-Nov	3265700	3270000	16297	1034.4	1040	5.6	2910.179	7.71
7-Nov	3275200	3284700	36005	1040	1051.8	11.8	3051.271	7.9
10-Nov	3284700	3291200	24635	1051.8	1059.6	7.8	3158.333	6.91
17-Nov	3295900	3302200	23877	1059.6	1065.7	6.1	3914.262	7.05
21-Nov	3302700	3306500	14402	1065.7	1070.8	5.1	2823.922	7.11
25-Nov	3312500	3313600	4169	1070.8	1072.4	1.6	2605.625	7
28-Nov	3318400	3323100	17813	1072.4	1078.7	6.3	2827.46	6.98

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WELL #3 **TAGISH WATERSHED FLOWMETER CHART**

	WELL FLOWMETER			WELL PUMP HOURMETER				
DATE 2008	READING IN	READING OUT	TOTAL LITERS	PUMP HR IN	PUMP HR OUT	PUMP HOURS	LITERS HOUR	CURRENT AMPS
3-Dec	3326600	3331200	17434	1078.7	1084.6	5.9	2954.915	7.86
8-Dec	3335100	3338200	11749	1084.6	1089	4.4	2670.227	7.65
15-Dec	3346600	3350900	16297	1089	1094.1	5.1	3195.49	7.52
17-Dec	3354000	3356900	10991	1094.1	1097.7	3.6	3053.056	7.08
22-Dec	3366400	3368200	6822	1097.7	1100.1	2.4	2842.5	7.66
24-Dec	3373100	3386300	50028	1100.1	1103.8	3.7	13521.08	
29-Dec	3386800	3395600	33352	1103.8	1109.3	5.5	6064	

CARCROSS / TAGISH FIRST NATION
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WELL #3 **TAGISH WATERSHED FLOWMETER CHART**

	WELL FLOWMETER			WELL PUMP HOURMETER				
DATE 2009	READING IN	READING OUT	TOTAL LITERS	PUMP HR IN	PUMP HR OUT	PUMP HOURS	LITERS HOUR	CURRENT AMPS
Jan.5	3395600	3399900	16297	1109.3	1114.6	5.3	3074.906	7.06
Jan.7	3403500	3406000	9475	1114.6	1117.5	2.9	3267.241	6.96
Jan.14	3412900	3414700	6822	1117.5	1119.8	2.3	2966.087	7.25
Jan.20	3426200	3427300	4169	1119.8	1121.4	1.6	2605.625	7.23
Jan.28	3436400	3438200	6822	1121.4	1124	2.6	2623.846	6.93
Jan.28	3438500	3439500	3790	1124	1125.3	1.3	2915.385	
**Flowmeter values in U.S. Gallons								

CARCROSS / TAGISH FIRST NATION
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WELL #3   **TAGISH WATERSHED FLOWMETER CHART**

	WELL FLOWMETER			WELL PUMP HOURMETER				
DATE 2009	READING IN	READING OUT	TOTAL LITERS	PUMP HR IN	PUMP HR OUT	PUMP HOURS	LITERS HOUR	CURRENT AMPS
Feb.02	3444700	3449100	16676	1125.3	1131.1	5.8	2875.172	7.15
Feb.05	3459400	3463300	14781	1131.1	1136.7	5.6	2639.464	7.18
Feb.09	3467100	3470300	12128	1136.7	1141	4.3	2820.465	7.15
Feb.12	3476300	3479200	10991	1141	1144.9	3.9	2818.205	7.01
Feb.17	3484600	3486300	6443	1144.9	1146.9	2	3221.5	7.08
Feb.19	3490700	3499500	33352	1146.9	1159.7	12.8	2605.625	7.79
Feb.25	3501300	3506000	17813	1159.7	1164.9	5.2	3425.577	7.01
Feb.27	3511400	3516400	18950	1164.9	1170.3	5.4	3509.259	7.1
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**Flowmeter values in U.S. Gallons								

APPENDIX C

APPENDIX C CONTAMINATED SITE AND SPILL SEARCH RESULTS

Search results from:

1) Nathalie Lowry of Yukon Government for Spill Records search up to 2001 in Carcross Tagish First Nation – Tagish Community, Tagish, YT.

2) Matthew Nefstead of Yukon Government for CSR and Devolution Search in Carcross Tagish First Nation – Tagish Community, Tagish, YT.

Carol Ma

From: Lowry,Nathalie [PYR] [Nathalie.Lowry@ec.gc.ca]
Sent: Tuesday, August 11, 2009 12:50 PM
To: Carlene Hajash
Subject: RE: Spills records search-W23101256
Attachments: Tagish.pdf

Attached are the spill report summaries for Tagish. For complete records after 2001 please contact Yukon Government Environmental Programs.

Thanks,
Nathalie

Nathalie Lowry, B.Sc., M.GIS
Coordinator Emergency Planning, Prevention and Liaison
Environmental Emergencies Program Yukon
Environmental Protection - Environment Canada
91782 Alaska Highway, Whitehorse, YT Y1A 5B7
Work: 867.667.3405 Cell: 867.333.9917

From: Carlene Hajash [mailto:chajash@eba.ca]
Sent: Monday, August 10, 2009 10:47 AM
To: Lowry,Nathalie [PYR]
Cc: David-Scott McQuinn; Carol Ma
Subject: Spills records search-W23101256

Hello Nathalie,

EBA is conducting a Source Water Protection for Tagish, Yukon.

The UTM coordinates for well # 3 is approximately 6 686, 677 N and 540, 964 E in Zone 8.

I would appreciate a review of the spills records from Environment Canada to determine if there have been any documented spills near well # 3 within a 5 km radius. Thank you for your assistance. If you require any further information, please feel free to contact me.

Please note that your response will be included with the final report, for record keeping.

This information is requested for August 14, 2009 and any help to meet this tight deadline would be

appreciated.

Thanks,

Carlene

Carlene Hajash, B.Sc.
Environmental Scientist
p. 867.668.2071 x249 ~ f. 867.668.4349
e. chajash@eba.ca
EBA Engineering Consultants Ltd.
Calcite Business Centre, Unit 6, 151 Industrial Road
Whitehorse, Yukon Y1A 2V3 ~ CANADA
CREATING AND DELIVERING BETTER SOLUTIONS
www.eba.ca

Environment Canada Environnement Canada

Emergencies Program - Yukon Section
91782 Alaska Highway, Whitehorse, YT Y1A 5B7
PH: 867.667.3400 FAX: 867.667.7962

Spill Report Information

Spill #	8922
Jurisdiction	Yukon
Community	Tagish
Address	
Highway	
Milepost	
Feature	Tagish
Location / Cause	D & K Logging Road near Tagish Road - truckload of raw sewage dumped into swampy area on E side of road
Incident Date	1989/11/20 9:00:00 AM
Lead Agency	Health Canada
Other Agency	Department of Indian Affairs and Northern Development
Major Contaminant	Raw Sewage
2nd Contaminant	
3rd Contaminant	
4th Contaminant	
Amount	1
Units	Tonnes (Metric)
Concentration	
Units	
Quantity	Actual
Addl Quanitity Info	
Phase	Liquid
Release	Dumped
Outcome	spill confined to general area - poorly drained area - operator requested to decontaminate area and monitor site in spring

Environment Canada Environnement Canada

Emergencies Program - Yukon Section
91782 Alaska Highway, Whitehorse, YT Y1A 5B7
PH: 867.667.3400 FAX: 867.667.7962

Spill Report Information

Spill #	9219
Jurisdiction	Yukon
Community	Tagish
Address	Lot 86 Taku Subdivision
Highway	
Milepost	
Feature	Tagish Lake
Location / Cause	turn left at California Beach - abandoned yellow barrel marked "Dry Cleaning Solvent" - not leaking
Incident Date	1992/11/03
Lead Agency	Yukon Government - Transportation
Other Agency	Environment Canada - Environmental Protection Service
Major Contaminant	Waste Oil
2nd Contaminant	
3rd Contaminant	
4th Contaminant	
Amount	100
Units	Litres
Concentration	
Units	
Quantity	Potential
Addl Quanitity Info	
Phase	Liquid
Release	
Outcome	YTG inspected - will instruct property owner on disposal and removal - YTG not necessarily removing - will accept waste oil at designated center

Environment Canada Environnement Canada

Emergencies Program - Yukon Section
91782 Alaska Highway, Whitehorse, YT Y1A 5B7
PH: 867.667.3400 FAX: 867.667.7962

Spill Report Information

Spill #	9234
Jurisdiction	Yukon
Community	Tagish
Address	
Highway	
Milepost	
Feature	Tagish
Location / Cause	NWTel tower - caller reported fuel being pumped into a bladder - bladder leaking enough to form a stream
Incident Date	1992/06/24
Lead Agency	Environment Canada - Environmental Protection Service
Other Agency	
Major Contaminant	Diesel
2nd Contaminant	
3rd Contaminant	
4th Contaminant	
Amount	
Units	
Concentration	
Units	
Quantity	Unknown
Addl Quanitity Info	
Phase	Liquid
Release	Spilled
Outcome	NWTel sent people out to inspect - bladders being used to store fuel while UST's being replaced - one rolled downhill but spillage was minimal

Environment Canada Environnement Canada

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Spill Report Information

Spill #	9511
Jurisdiction	Yukon
Community	Tagish
Address	
Highway	
Milepost	
Feature	Tagish Lake
Location / Cause	Tagish Marina - leaking fuel storage tank - tank leaks when full
Incident Date	1995/05/08
Lead Agency	Environment Canada - Environmental Protection Service
Other Agency	Yukon Government - Fire Marshall
Major Contaminant	Gasoline
2nd Contaminant	
3rd Contaminant	
4th Contaminant	
Amount	
Units	
Concentration	
Units	
Quantity	Unknown
Addl Quanitity Info	
Phase	Liquid
Release	Leaked
Outcome	tank has been patched in past with soap but not repaired - no berms around tanks - to be inspected by EP and YTG Fire Marshall

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Spill Report Information

Spill #	9619
Jurisdiction	Yukon
Community	Tagish
Address	Lot 200
Highway	
Milepost	
Feature	Tagish
Location / Cause	oil barrel tipped over in back of truck - oil and gas on residents land and Crown Land
Incident Date	1996/05/03
Lead Agency	Yukon Government - Renewable Resources
Other Agency	Environment Canada - Environmental Protection Service
Major Contaminant	Waste Oil
2nd Contaminant	Gasoline
3rd Contaminant	Ethylene Glycol
4th Contaminant	
Amount	
Units	
Concentration	
Units	
Quantity	Unknown
Addl Quanitity Info	
Phase	Liquid
Release	Spilled
Outcome	EP inspected site - no threat to lake - all material located next to road right-of-way - referred to YTG RR

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Spill Report Information

Spill #	9639
Jurisdiction	Yukon
Community	Tagish
Address	
Highway	
Milepost	
Feature	Tagish Lake
Location / Cause	beach of Tagish Lake north of Tagish Subdivision - rust colored stain in line on beach - waste oil being dumped at dump
Incident Date	1996/06/26
Lead Agency	Environment Canada - Environmental Protection Service
Other Agency	
Major Contaminant	Unknown Substance
2nd Contaminant	
3rd Contaminant	
4th Contaminant	
Amount	
Units	
Concentration	
Units	
Quantity	Unknown
Addl Quanitity Info	
Phase	
Release	
Outcome	10 ft above high water mark - smell of hydrocarbons not noted - also concerned about waste oil - EC directed caller to YG Special Waste Regs and community

Carol Ma

From: Matthew.Nefstead@gov.yk.ca
Sent: Wednesday, August 12, 2009 10:58 AM
To: Carlene Hajash
Subject: RE: Contaminated Sites & Spill Record Search-W23101256

Hello Carlene,

The Environmental Programs Branch has information on the following sites that may be within your area of interest. Please note that a lack of information regarding additional sites does not mean that such additional sites do not exist.

- Tagish Bridge Dump: this dump site, located approximately 1 km east of Tagish on the Tagish Road, was decommissioned in 1998. I do not have a specific location, and I have very little information on the thoroughness of the decommissioning. You may be able to get more information from Community Services – I'd start with Kriss Sarson.
- Old Sewage Lagoon: a sewage lagoon in Tagish was decommissioned in 2008. It was located at Lot 1100 Quad 105D/08, approximately 4.8 km SSW from the well location you provided. A large amount of contaminated sludge and water was removed when the site was decommissioned, but one confirmatory sample from the soil remaining on site showed chromium levels in excess of the standard for protection of groundwater used for drinking water. Please note that this standard is normally only applied to soil within 1.5 km of a drinking water source.

Please let me know if you would like to view any of our files or if you require further information.

Regards,

Matthew Nefstead
Contaminated Sites Analyst
Yukon Department of Environment (V-8)
(867) 667-5076

-----Original Message-----
From: Carlene Hajash [mailto:chajash@eba.ca]
Sent: Monday, August 10, 2009 10:41 AM
To: Matthew.Nefstead
Cc: David-Scott McQuinn; Carol Ma
Subject: Contaminated Sites & Spill Record Search-W23101256

EBA is conducting a Source Water Protection for Tagish, Yukon.

The UTM coordinates for well # 3 is approximately 6 686, 677 N and 540, 964 E in Zone 8.

I would appreciate a review of the spill records to determine if there have been any documented spills near well # 3 within a 5 km radius. Thank you for your assistance. If you require any further information, please feel free to contact me.

Please note that your response will be included with the final report, for record keeping.

This information is requested for August 14, 2009 and any help to meet this tight deadline would be appreciated

Thanks

Carlene

Carlene Hajash, B.Sc.
Environmental Scientist
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www.eba.ca

APPENDIX D

APPENDIX D ENVIRONMENTAL REPORT – GENERAL CONDITIONS

ENVIRONMENTAL REPORT – GENERAL CONDITIONS

This report incorporates and is subject to these "General Conditions".

1.0 USE OF REPORT AND OWNERSHIP

This report pertains to a specific site, a specific development, and a specific scope of work. It is not applicable to any other sites, nor should it be relied upon for types of development other than those to which it refers. Any variation from the site or proposed development would necessitate a supplementary investigation and assessment.

This report and the assessments and recommendations contained in it are intended for the sole use of EBA's client. EBA does not accept any responsibility for the accuracy of any of the data, the analysis or the recommendations contained or referenced in the report when the report is used or relied upon by any party other than EBA's Client unless otherwise authorized in writing by EBA. Any unauthorized use of the report is at the sole risk of the user.

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2.0 ALTERNATE REPORT FORMAT

Where EBA submits both electronic file and hard copy versions of reports, drawings and other project-related documents and deliverables (collectively termed EBA's instruments of professional service), only the signed and/or sealed versions shall be considered final and legally binding. The original signed and/or sealed version archived by EBA shall be deemed to be the original for the Project.

Both electronic file and hard copy versions of EBA's instruments of professional service shall not, under any circumstances, no matter who owns or uses them, be altered by any party except EBA. The Client warrants that EBA's instruments of professional service will be used only and exactly as submitted by EBA.

Electronic files submitted by EBA have been prepared and submitted using specific software and hardware systems. EBA makes no representation about the compatibility of these files with the Client's current or future software and hardware systems.

3.0 NOTIFICATION OF AUTHORITIES

In certain instances, the discovery of hazardous substances or conditions and materials may require that regulatory agencies and other persons be informed and the client agrees that notification to such bodies or persons as required may be done by EBA in its reasonably exercised discretion.