25.0 BUILDING 4981: WATSON LAKE ENERGY, MINES, AND RESOURCES OFFICE

25.1 Description of Existing Water system

Building 4981, the Watson Lake Energy, Mines, and Resources Office, is supplied water from a 22.7 m deep well located in a pit approximately 2 m from the building. The well location and other site details are provided by Figure 4981-A in Appendix A25. The coordinates of the wellhead, as measured by a handheld GPS device, were recorded as:

- UTM ZONE 9
- Northing: 6658342
- Easting: 515715

The water system is equipped with an AMG filter and a water softening system, and there is also a reverse osmosis treatment system that supplies water to one tap in the office kitchen. A schematic detailing the well water system is provided as Figure 4981-B in Appendix A25.

25.2 Description of Existing Wastewater Systems

The Watson Lake Energy, Mines, and Resources Office is served by a septic system located on the southwest side of the office building. The septic tank is approximately 13 m west of the well and likely discharges effluent to the west of the tank. Additionally, there is a septic field serving one of the neighboring buildings that is approximately 45 m northeast of the well, and a sinkhole that likely marks the location of an abandoned septic tank approximately 32 m north of the well.

25.3 Water Quality Results

25.3.1 Water Quality Results from Previous Sampling

Bacteriological

Eight samples were collected from the Watson Lake Energy, Mines, and Resources Office water system between September 2004 and March 2005 and were tested for total coliform and *E. coli* by Yukon Environmental Health Services using the

presence/absence test method. Results are tabulated in Table 4981-1 in Appendix 25. Coliform bacteria and *E. coli* were reported as absent in each of the eight samples for which results were provided.

Potability

A water sample was collected by YTG representatives from the Watson Lake Energy, Mines, and Resources Office water system on October 13, 2004. The sample was submitted to Northwest Labs in Surrey, BC for potability analyses. The results of these analyses are summarized in Table 4981-2 in Appendix A25. EBA reviewed the analytical results to compare them with the Canadian Drinking Water Quality Guidelines (CDWQG) to observe general water quality, identify and recommend additional sampling and analytical, and to identify potential indicators of contamination.

- At 36.1 NTU, turbidity significantly exceeded both the CDWQG MAC of 1.0 NTU and aesthetic objective of 5.0 NTU;
- At 1.39 mg/L, the barium concentration exceeded the CDWQG MAC of 1.0 mg/L;
- At a level of greater than 60 CU, the colour exceeded the CDWQG aesthetic objective of 15 CU.
- At 0.0053 mg/L, the arsenic concentration exceeded the new proposed CDWQG MAC of 0.005 mg/L;
- At 289 mg/L, the chloride concentration was above the CDWQG aesthetic objective of 250 mg/L;
- At 2.85 mg/L, the iron concentration exceeded the CDWQG aesthetic objective of 0.3 mg/L;
- At 0.576 mg/L, the manganese concentration exceeded the CDWQG aesthetic objective of 0.05 mg/L;
- At 628 mg/L, the total dissolved solids exceeded the CDWQG aesthetic objective of 500 mg/L; and,
- All other health based and aesthetic objectives were met for the parameters analyzed. The hardness (as $CaCO_3$) was 541 mg/L, and is considered unacceptably hard.

25.3.2 Identification of Additional Analytical Testing Required

From the raw, untreated water, the following samples were taken:

- Detailed potability; and,

- Analysis for EPH and PAH to determine if the water supply shows signs of hydrocarbon contamination.

From softened water, the following samples were taken:

- Detailed potability;
- Dissolved metals to compare with total metals concentrations;
- Ammonia;
- Total organic carbon concentration; and,
- Measurements in the field for total dissolved solids, conductivity, pH, and temperature.

Samples of the RO treated water (post softener and RO at the dedicated drinking water tap in the kitchen) included:

- Detailed potability;
- Measurements in the field for total dissolved solids, conductivity, pH, and temperature.

Additional Analytical Results

A water sample was obtained by EBA during the field program on June 21, 2005, and was submitted to ALS Environmental in Vancouver, BC for the analyses indicated above. These results are summarized in Table 4981-2 in Appendix A25 and the laboratory reports are included in Appendix B.

Results from previous sampling show that there was likely no treatment system at the time when baseline water quality analysis was taken, and this water likely shows raw water quality.

Raw water results are summarized below:

- Groundwater was calcium chloride type water with very high hardness;
- At 15.9 NTU, was well above the CDWQG MAC of 1.0 NTU;
- At 0.794 mg/L, the barium concentration was considered to be very high for groundwater in the Watson Lake area;
- The total dissolved solids concentration at 1240 mg/L indicated that the water was brackish;
- At 298 mg/L the chloride concentration was very high relative to background water quality;
- The total iron concentration of 1.28 mg/L was above the CDWQG aesthetic objective;

- The total manganese concentration of 1.01 mg/L, was above the CDWQG aesthetic objective.
- Analytical results for EPH and PAH indicated that concentrations for every parameter tested were less than detection limits and CDWQG.

It was observed during the site inspection that the softener system at this site had been recently installed. Results from additional analytical sampling show that there was an improvement of the water quality from the raw water samples:

- At 0.28 NTU, turbidity had been lowered below both the CDWQG MAC and AO;
- The barium concentration had been reduced to below the detection limit of 0.20 mg/L;
- The total dissolved solids had been reduced from 1240 mg/L to 996 mg/L, but was above CDWQG aesthetic objective and is considered brackish;
- At 299 mg/L the chloride concentration had not changed and remained above the CDWQG aesthetic objective;
- The total iron concentration had been reduced to less than the detection limit of 0.030 mg/L, and,
- The total manganese concentration had been reduced to less than the detection limit of 0.020 mg/L.

Results from the sample collected post reverse osmosis treatment showed further improvement as indicated below:

- The total dissolved solids had been significantly reduced to 48 mg/L; and,
- At 20.3 mg/L the chloride concentration had been reduced to below the CDWQG aesthetic objective;

Follow up baseline sample results were provided by YTG for a sample collected on June 22, 2005. These results are summarized in Table 4981-2 in Appendix A25. The results indicate that the sample was likely collected from the softened water, but not the RO treated water. The analytic results for this sample are consistent with previous results, which indicate chloride concentrations above the CDWQG aesthetic objective.

25.3.3 Indicators of Potential Contamination

Chloride, nitrate and nitrite concentrations can indicate impacts from surface water sources or septic waste. Chloride concentrations reported from baseline and additional analytical water quality results were very high (between 272 mg/L and 299 mg/L). Nitrate, nitrite, and ammonia concentrations reported from baseline and

additional analytical water quality results, however, were found to be low and were within the normal background range for the Watson Lake area.

The Town of Watson Lake sewage lagoon is likely upgradient from the well and it is considered probable this that is causing the high chlorides reported in this water system. Other wells in the area downgradient from the sewage lagoon also have elevated chloride concentrations.

Concentrations of total barium reported from baseline and additional analytical water quality results were observed to be 1.39 mg/L and 0.794 mg/L, respectively and are considered to be elevated above background groundwater concentrations. It is possible that a barite plant located upgradient of the site is the cause of the elevated barium observed in the region.

Considering the proximity of this well and surrounding wells to both a barite plant and a sewage lagoon, additional hydrogeological assessment and water quality analysis is recommended.

25.4 Conceptual Hydrogeology

The log for this well indicates that the well is completed at a depth of 22.9 m in a sand a gravel aquifer. The lithology consists of 15.2 m of silty sand overlying 7.7 m and permeable sand and gravel. No static water level information is available. The lithology is consistent with that of the nearby grader station well, which indicates alternating fine and coarse material to a depth of 17.8 m. The well is located on the north side of a groundwater divide, the direction of groundwater flow is inferred to be easterly to northeasterly towards Wye Lake.

25.5 Potential Contaminant Sources

Potential contaminant sources observed during the site investigation are provided in field notes in Appendix A25. Photos of potential contaminant sources are also provided in this appendix.

A summary of potential contaminant sources within 30 m of the well is provided below:

- Septic tank at 13 m (in contravention of regulation);
- Above ground fuel storage tank at 13 m;
- An industrial junkyard at 20 m; and,
- Scrap metal parts at 20 m.

Additionally, there is a barite plant and a sewage lagoon that are inferred to be located upgradient from the well.

25.5.1 Spills Records and Contaminated Sites Search Results

The Government of Yukon Environment Branch did not identify any recorded spill events or contaminated sites issues for this property or neighbouring properties.

25.6 Identified Water System Deficiencies and Associated Risk

25.6.1 High and Medium Risk Deficiencies

- The wellhead is located within 30 m of potential sources of contamination, including the septic tank, an industrial junkyard, and scrap metal parts;
- There is no surface sanitary seal (grout or bentonite seal as required by the Canadian Groundwater Association's Well Construction Guidelines);
- Poor surface completion of the wellhead (located in a pit, the wellhead was open with no cap on the casing);
- By definition of the Draft Yukon GUDI Assessment Guideline, the well is potentially under the direct influence of surface water because it does not meet the requirements of the Guidelines for Water Well Construction;
- There is no disinfection system. There is, however, a treatment system consisting of an AMG filter, a water softener, and a reverse osmosis device. This treatment system was not functioning properly at the time of inspection and had to repaired by one of the inspection team members;
- Water quality data indicates that the raw groundwater quality is very poor, and could pose a risk if the treatment system ceases to function properly. There were historical exceedences of CDWQG MAC for turbidity and barium in untreated water;

- The well is located downgradient from a barite plant; the high barium concentrations observed in raw water would be a high-risk if the treatment system were ever to malfunction;
- The well is located approximately 390 m from the Town of Watson Lake sewage lagoon, and the lagoon is likely upgradient from the well. Water quality analyses indicate elevated chlorides in exceedence of CDWQG aesthetic objectives, providing evidence that this aquifer may be being impacted from the sewage lagoon; and,
- The softener system and RO filter drains are not properly installed and may be subject to cross contamination.

25.6.2 Low Risk Deficiencies

- The arsenic concentration reported for baseline raw water sampling event was slightly in exceedence of the proposed CDWQG MAC; and,
- The total and dissolved manganese concentrations in the raw water are in exceedence of CDWQG aesthetic objectives.

25.7 Mitigative Options for Deficiencies

Mitigative options were developed to address the deficiencies identified in the previous section. Deficiencies are categorized by recommended level of priority (with Priority 1 being most critical).

25.7.1 Priority 1

The following Priority 1 mitigative options should be carried out to address the deficiencies associated with the water system at the Watson Lake Energy, Mines, and Resources Office:

- The well and water system should be superchlorinated and a cap be installed on the wellhead;
- It is recommended that an NSF/ANSI 55 certified UV disinfection system be installed. This is a conceptual design recommendations based on the information available for planning and budgeting purposes. Engineering input will be required for final system specifications;
- Regular monitoring, maintenance should be completed on a daily basis to ensure the water treatment system is always functioning properly;

- Signs should be posted at all points of use on this water system to inform building users that only water from the dedicated drinking water tap in the kitchen area is suitable for drinking; and,
- The reverse osmosis and softener drains should be re-plumbed in order to provide air gaps.

25.7.2 Priority 2

The following mitigative options should be carried out to address the medium-risk deficiencies associated with the water system at the Watson Lake Energy, Mines, and Resources Office:

- The wellhead completion should be improved. This would involve raising the well casing to a minimum of 500 mm above ground level and retrofitting a proper surface-seal to 3 m below grade;
- The ground surface around the wellhead should be graded to promote surface drainage away from the well;
- An additional assessment should be done in order to determine the location of the start of the effluent field; and,
- A detailed hydrogeological assessment should be carried out in order to determine if the sewage lagoon and the barite plant are contaminating the aquifer that provides groundwater to this facility.

25.7.3 Priority 3

- There are no Priority 3 mitigative options recommended for this site.

25.8 Cost Estimates for Mitigative Options

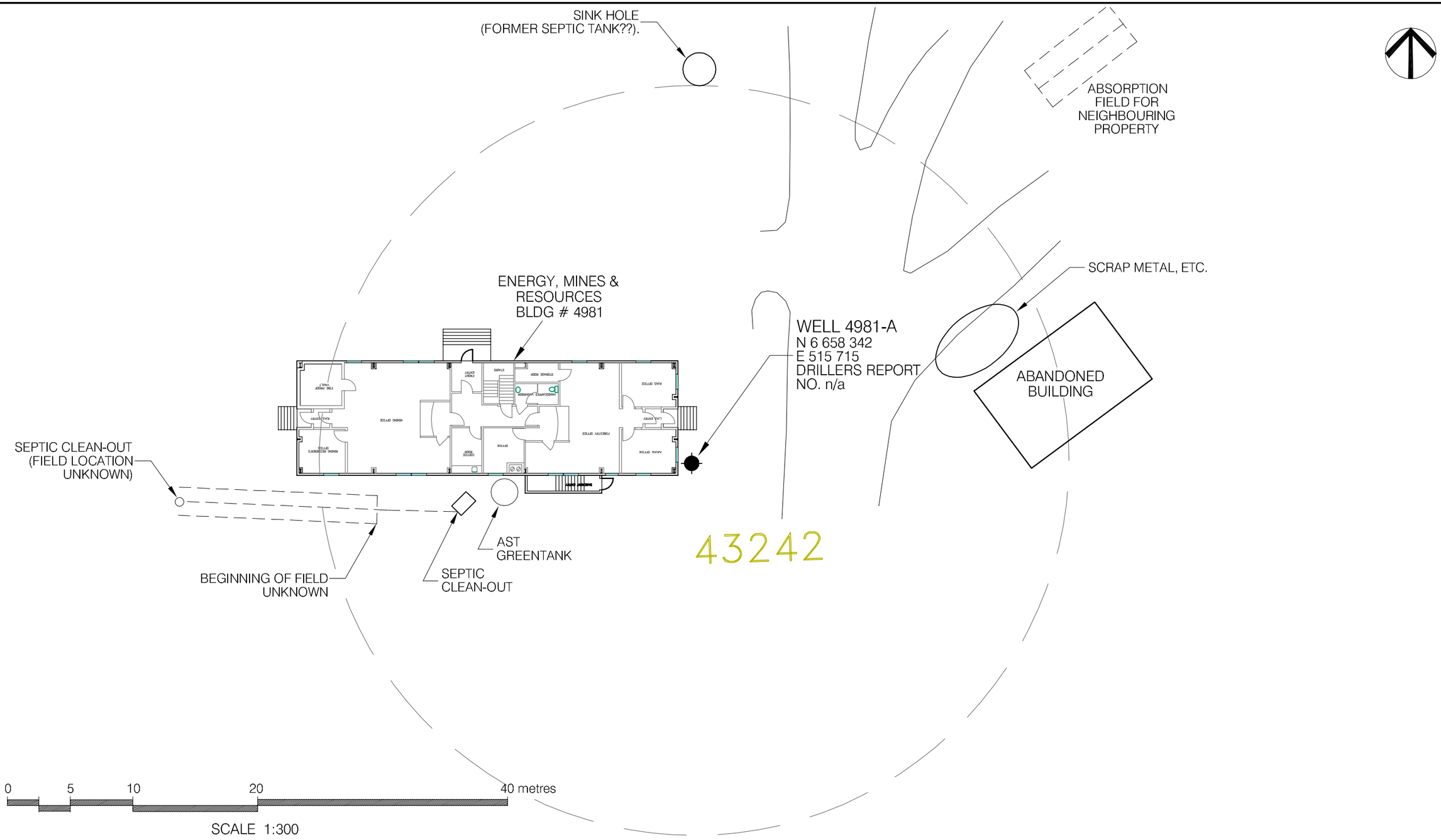
Engineering costs for mitigative options are estimated to be 20% of construction costs, and would include inspection and completion reporting. The costs for materials and labour (not including engineering) are provided in the sections below. An additional contingency allowance of 20% is suggested for budgetary purposes.

25.8.1 Priority 1

- To superchlorinate the well and water system, and install a proper cap would likely cost in the order of **$250**;
- The cost for a UV disinfection system would be approximately **$2,200**;
- Approximately **$250** should be allocated to replumb the reverse osmosis and softener drains;
- Ensuring that the water treatment system is in proper working order should be completed under normal operations and maintenance costs; and,
- Posting a signs would incur minimal cost.

25.8.2 Priority 2

- The cost for the wellhead upgrades, including raising the casing, installing a surface seal to 3 m below grade, and installing a 150 mm commercial pitless unit would cost in the order of **$5,000**;
- Determining the location of the start of the effluent field should incur minimal cost; and,
- Conducting a detailed hydrogeological study, including drilling a series of monitoring wells, to determine if the barite plant is the cause of elevated barium in the area, would cost in the order of **$20,000**. Since there are two other YTG maintained facilities in the area whose wells show similar signs of contamination, the cost for this site would be approximately **$6,700**.



NOTES:

1. UTM COORDINATES OBTAINED WITH A HAND HELD GPS USING NAD83 SYSTEM AND ARE CONSIDERED TO BE ACCURATE TO 10.0 m, APPROXIMATELY.

30 m RADIUS FROM WATER WELL FOR CONSIDERATION OF PROXIMITY TO POTENTIAL CONTAMINANT SOURCES.

No.	DESCRIPTION	DATE	APPROVED
0	ISSUED FOR CLIENT REVIEW	DD/MM/YY	XXX

REVISION

EBA Engineering Consultants Ltd.

DESIGNED BY:	R. MARTIN
DRAWN BY:	J. BUYCK
DATE:	JULY 2005
SCALE:	AS SHOWN
PROJECT No.:	1260002.002
ACAD FILENAME:	002-EASTERN REGION

CLIENT: Yukon
Highways and Public Works
Property Management Branch

SMALL PUBLIC WATER SYSTEMS ASSESSMENT
EASTERN REGION

GOVERNMENT OF YUKON
HIGHWAYS & PUBLIC WORKS

WATSON LAKE ENERGY, MINES, & RESOURCES BUILDING # 4981
SITE LOCATION DIAGRAM
WELL ID: 4981-A

REVISION ISSUE: 0

FIGURE No.: 4981-A

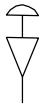
LEGEND


PUMP


PRESSURE GAUGE


GATE VALVE


CHECK VALVE

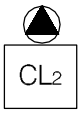

SOLENOID

#2 COMPONENT ID. No.
(SEE TABLE ON FOLLOWING PAGE)

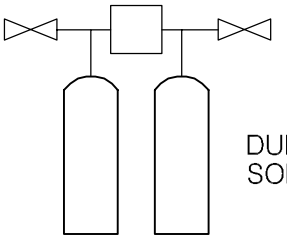
FLOW METER

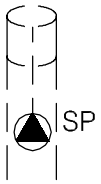
WATER FILTER
(CARTRIDGE TYPE)

PRESSURE TANK

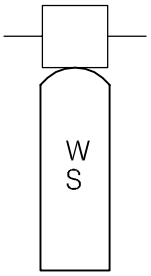


CHLORINE RESERVOIR AND
INJECTION PUMP


DUPLEX WATER
SOFTENER

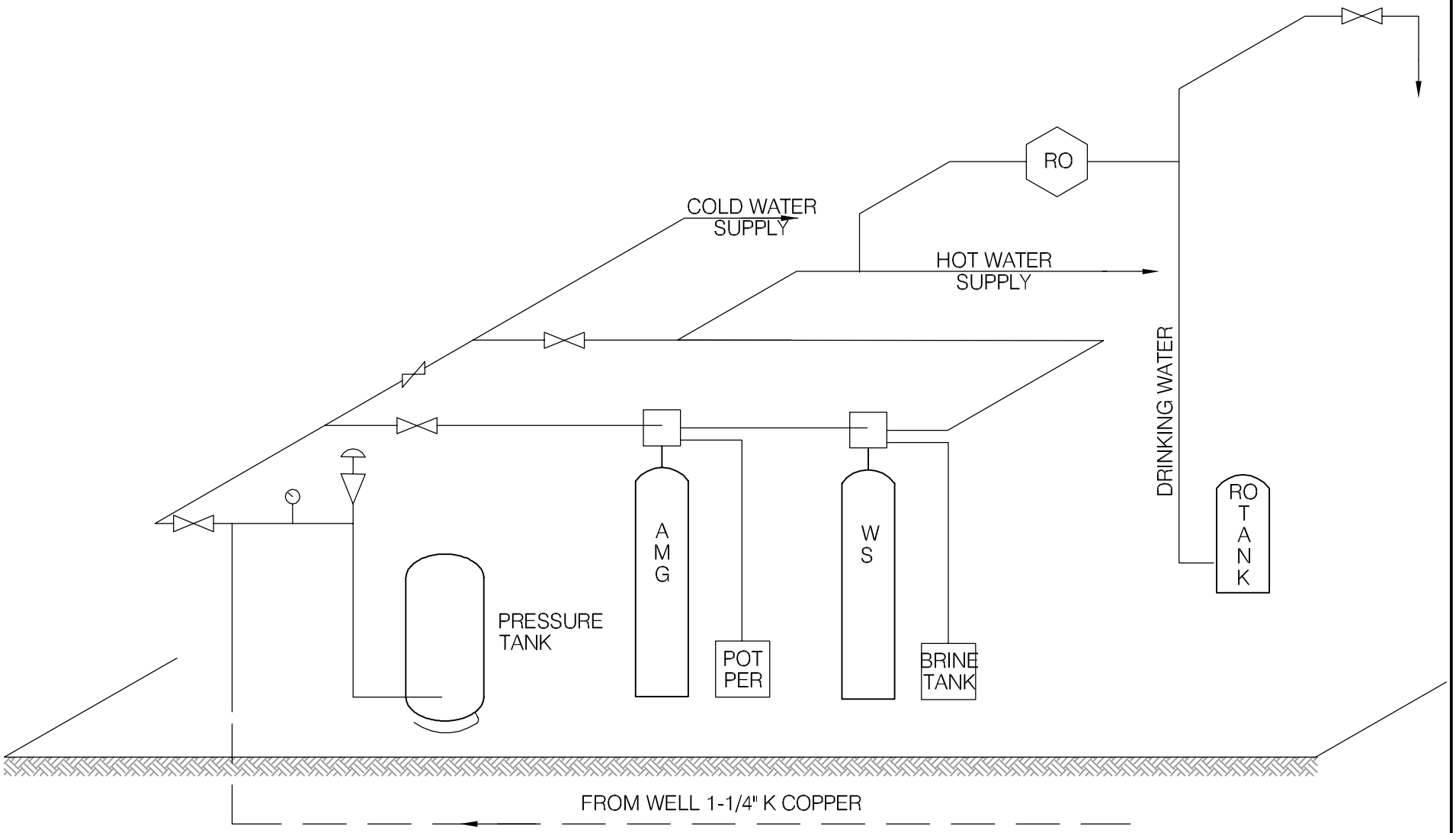


WELL WITH
SUBMERSIBLE PUMP



ACTIVATED
CARBON

EBA Engineering Consultants Ltd.			PROJECT	SMALL PUBLIC WATER SYSTEMS ASSESSMENT EASTERN REGION	
CLIENT Yukon Highways and Public Works Property Management Branch			TITLE	SCHEMATIC SYSTEM LEGEND	
DATE APRIL 2006	DWN. JSB	CHKD. RMM	FILE NO. 1260002		DRWG. LEGEND



SCHEMATIC PRODUCED BY BERT ALBISSER OF AQUA TECH SUPPLIES & SERVICES LTD.

EBA Engineering Consultants Ltd.			PROJECT	SMALL PUBLIC WATER SYSTEMS ASSESSMENT EASTERN REGION	
CLIENT Yukon Highways and Public Works Property Management Branch			TITLE	WATER SYSTEM DISTRIBUTION/TREATMENT SCHEMATIC SYSTEM ID.: 4981 WATSON LAKE ENERGY, MINES, & RESOURCES OFFICE	
DATE JULY 2005	DWN. JSB	CHKD. RMM	FILE NO. 1260002.002		DWG.: FIGURE 4981-B

Z:\0201Drawings\1260002 Water Assessment YTG\002 - Eastern Region\watson\Schematics\1260002 EMR Office_4981 Schematic.dwg, 7/21/2005 4:26:59 PM, Adobe PDF

Eastern Region – Energy/Mines Office
Building # 4981

DISTRIBUTION & TREATMENT SYSTEM DATA

Item	Description	Manufacturer	Model	Part No.	Serial No.	Size
1	MG FILTER	PETWA	02-2002-22		25210	12 x 52
2	SOFTENER	PETWA	01-150063		25209	10" x 54"
3	REVERSE OSMOSIS	USFILTER	E75TFC-3SF		75807	75GPD
4	RO TANK	WELL MATE	WM0075		02506371	75L
5	PRESSURE TANK	WELL RITE	WR200-02			
6	PRESSURE SWITCH	SQ. D	FSG-2			
7	PRESSURE GAUGE	MARSH	0-100			2 11
8	SUB. PUMP.	MONARCH	SK.			4" - 1/2 HP.
9						
10						

TABLE 4981- 1: SUMMARY OF BACTERIOLOGICAL RESULTS

Building #	Building Name	Number of Sampling Events	Time Period over which Sampling was Done	Any Positive Total Coliform Results? (yes or no)	Fraction of Positive Total Coliform Results vs. Total Sampling Events	Any positive E.Coli results? (yes or no)	Most Recent Sampling Event Available for EBA Review	Is Most Recent Result Positive?
4981	Energy, Mines, and Resources Office	8	Sept-04 to Mar-05	no	0/8	no	9-Mar-05	no

Table 4981-2: Water Quality Results

SOURCE:	Building 4981 - Energy, Mines and Resources Office				GCDWQ Criteria		
Location/ Resident	Watson Lake						
Address							
Treatment		None	Filter and Water Softener	Reverse Osmosis			
Disinfection	No						
Source of Water	On-Site Well						
Purpose of Sampling	Baseline	Additional Sampling	Additional Sampling	Additional Sampling			
Sample Location		Washroom Sink	Washroom Sink	Kitchen RO Tap			
Date Sampled	13-Oct-04	21-Jun-05	21-Jun-05	21-Jun-05	Lower	Upper Limit	
Physical Tests *(ALS)*					AO	MAC	AO
Colour (CU)	>60	<5.0	<5.0	<5.0			15
Conductivity (uS/cm)		1250	1550	90.1			
Total Dissolved Solids	628	1240	996	48			500
Hardness CaCO3	541	531	<6.6	6.59	AO >200 = poor, > 500 unacceptable[A]		
pH	7.86	7.96	8.14	6.54	6.5		8.5
Turbidity (NTU)	36.1	15.9	0.28	0.720		1	5
Dissolved Anions *(ALS)*							
Alkalinity-Total CaCO3	188	194	207	7.6			
Chloride Cl	285	298	299	20.3			250
Fluoride F	<0.2	<0.20	<0.20	<0.020		1.5	
Sulphate SO4	7.34	<5.0	<5.0	<0.50			500
Nitrate Nitrogen N	<0.05	<1.0	<1.0	<0.10		10	
Nitrite Nitrogen N	<0.02	<1.0	<1.0	<0.10		1	
Ammonia Nitrogen N			<0.020				
Total Metals *(ALS)*							
Aluminum T-Al	<0.005	<0.020	<0.10	<0.010			
Antimony T-Sb	<0.0002	<0.0010	<0.0050	<0.00050		0.006	
Arsenic T-As	*0.0053*	0.00418	0.0023	0.00068		0.025	
Barium T-Ba	1.39	0.794	<0.20	<0.020		1	
Boron T-B	0.016	<0.20	<1.0	<0.10		5	
Cadmium T-Cd	<0.00001	<0.00040	<0.0020	<0.00020		0.005	
Calcium T-Ca		170	2.3	2.14			
Chromium T-Cr	0.0053	<0.0040	<0.020	<0.0020		0.05	
Copper T-Cu	0.001	0.0159	<0.010	<0.0010		1	
Iron T-Fe	2.85	1.28	<0.030	<0.030			0.3
Lead T-Pb	<0.0001	<0.0020	<0.010	<0.0010		0.01	
Magnesium T-Mg		26	<1.0	0.3			
Manganese T-Mn	0.576	1.01	<0.020	0.0187			0.05
Mercury T-Hg		<0.00020	<0.00020	<0.00020		0.001	
Potassium T-K		2.12	515	17			
Selenium T-Se		<0.0020	<0.010	<0.0010		0.01	
Sodium T-Na	21.8	25.2	<2.0	2.2			200
Uranium T-U	<0.0005	0.00029	<0.0010	<0.00010		0.02	
Zinc T-Zn	0.004	<0.10	<0.50	<0.050			5
Dissolved Metals *(ALS)*							
Aluminum D-Al			<0.10			0.1	
Antimony D-Sb			<0.0050			0.006	
Arsenic D-As			0.0021			0.025	
Barium D-Ba			<0.20			1.0	
Boron D-B			<1.0			5	
Cadmium D-Cd			<0.0020			0.005	
Calcium D-Ca			1.9				
Chromium D-Cr			<0.020			0.05	
Copper D-Cu			<0.010				1.0
Iron D-Fe			<0.030				0.3
Lead D-Pb			<0.010			0.01	
Magnesium D-Mg			<1.0				
Manganese D-Mn			<0.020				0.05
Mercury D-Hg			<0.00020			0.001	
Potasium D-K			504				
Selenium D-Se			<0.010			0.01	
Sodium D-Na			<2.0				200
Uranium D-U			<0.0010			0.02	
Zinc D-Zn			<0.50				5.0
Organic Parameters							
Total Organic Carbon C			1.78				
Polycyclic Aromatic Hydrocarbons							
Acenaphthene		<0.000050					
Acenaphthylene		<0.000050					
Acridine		<0.000050					
Anthracene		<0.000050					
Benz(a)anthracene		<0.000050					
Benzo(a)pyrene		<0.000010				0.00001	
Benzo(b)fluoranthene		<0.000050					
Benzo(g,h,i)perylene		<0.000050					
Benzo(k)fluoranthene		<0.000050					
Chrysene		<0.000050					
Dibenz(a,h)anthracene		<0.000050					
Fluoranthene		<0.000050					
Fluorene		<0.000050					
Indeno(1,2,3-c,d)pyrene		<0.000050					
Naphthalene		<0.000050					
Phenanthrene		<0.000050					
Pyrene		<0.000050					
Quinoline		<0.000050					
Extractable Hydrocarbons							
EPH10-19		<0.30					
EPH19-32		<1.0					
LEPH		<0.30					
HEPH		<1.0					
Field Chemistry (EBA)							
pH			8.20	7.76	6.5		8.5
TDS (ppm)			750	76			500
EC (uS/cm)			1517	153			
Temperature (°C)			8	17.3			

Notes:

A. Guidelines indicated for hardness are not CDWQG, rather they are general aesthetic guidelines - exceedences are indicated in yellow highlighting.

Italics and underline indicates exceedence of proposed MAC (ie. arsenic)

Bold with Yellow highlighting indicates exceedence of CDWQG Aesthetic Objective (AO)

Bold Underline with Yellow highlighting indicates exceedence of CDWQG MAC

Results are expressed as milligrams per litre except for pH and Colour (CU), Conductivity (umhos/cm),Temperature (°C) and Turbidity (NTU)

< = Less than the detection limit indicated.

AO = Aesthetic Objective

MAC = Maximum Acceptable Concentration (Health Based)

Table 4981-3: Summary of Well Assessment Results
SMALL PUBLIC DRINKING WATER SYSTEMS

Well Identification			GPS Coordinates		
Building #	**Building Name**	**Location**	**Northing (+/- 10 m)**	**Easting (+/- 10 m)**	**Grade Elevation (+/- 10 m)**
4981	**Watson Lake Energy, Mines, and Resources Office**	**Watson Lake**	6658342	515715	707

Well Details							
Well Casing Diameter (mm)	**Year Well Installed**	**Well Log?**	**Well Depth (m bg)**	**Reported Low Permeabilty Protective Layer?**	**Pump Setting (m bg)**	**Well Capacity - Tested, or Reported by User**	**Static Water Level Below Ground (m-btwc)**
150	1975	Yes	23.0	Silt from surface to 15.3 m			

Potential Contaminant Sources					
Distance from well to nearest point of septic field (m)	**Distance from well to nearest building (m)**	**Distance to surface water body (m)**	**AST present on property?**	**Distance from well to AST (m)**	**Other potential sources of contamination observed on property, and distance to well**
13	2	Greater than 60 m	AST	12	Industrial Junkyard at approximately 20 m Scrap meatal at approximately 20 m Sink hole that may have been an old septic tank at 32 m

Well Construction Details					
Wellhead Above ground (m)	**Well Cap**	**Well Screen**	**Surface Seal**	**Apron Grading**	**Comments**
2.5 m below grade	Split seal gasket cap, but was not in place - well is open	Perforated piping from 20.9 m to 22.4 m.	No	No, but site is well drained	The well is down slope and down gradient from a barite plant and sewage lagoon.

EBA Engineering Consultants Ltd.

Creating and Delivering Better Solutions

SMALL PUBLIC WATER SYSTEM ASSESSMENT

PART A: EBA Site Inspection

Inspector: Ryan Martin
Lake Lebel

Date June 21, 2005

WELL ID #	Owner	Location Description
4981	YTG	Watson Lake Energy Mines and Resources office

1. Well Location and Potential Contaminant Sources

a. General location of well: (Community, Subdivision, etc.)
Watson Lake

b. Specific location: (Road or street, Building number, name of owner and/, legal description,
1007 Alaska Hwy Watson Lake

c. GPS location: N6 6 5 8 3 4 2 E 5 1 5 7 1 5 elv 707 ±11m

d Is there electric power? ☒ Yes ☐ No

e Is there outside water access? ☒ Yes ☐ No

f. Does the well system have:

☐ 15 or more service connections to a piped distribution system ? If so how many_____
Energy, Mines and Resources office

☐ 5 or more delivery sites on a trucked distribution system? If so how many_____

g. Nearest building, specify Energy, Mines and Resources office building

h. Distance from well to building ~ 2m

i. If there is an effluent disposal field, is its location known? ☒ Yes ☐ No

j. Distance from well to nearest point of known field: 13m N 6658336 E 515694

k. Well location relative to field: ☐ upslope ☐ downslope ☒ lateral

l. Is there any part of a sewage disposal system(s)or other potential sources of pollution that may pose a health and safety risk within 30 m? ☒ Yes ☐ No

N 6658371
E 515717 Sink hole → could be old septic @~32m, septic field and service lines <30m, 2nd septic field @~45m

m. Is the well located within 300 m from a sewage lagoon or pit? ☐ Yes ☒ No

n. Is the well located within 120 m from a solid waste site or dump, cemetery? ☐ Yes ☒ No

o. Is the infrastructure protecting the wellhead, pumphouse, storage tank and/or water treatment plant designed and secured to prevent:

Unauthorized access by humans? ☐ Yes ☒ No Entrance by animals? ☒ Yes ☐ No access possible, but unlikely.

p. Is well site subject to flooding? ☐ Yes ☒ No

q. Is the well site well drained? ☒ Yes ☐ No

r. Is there a buried fuel tank on the property? ☐ Yes ☒ No unlikely

If yes, is it ☐ in use ☐ abandoned

Is the location known? ☐ Yes ☐ No

Distance from the well to known buried tank _____

s. Are there any other known contaminant sources on the property?

☐ Yes ☐ No Describe _____

If yes, specify the source: ☐ dump ☐ sewage lagoon ☐ cemetery ☐ other

Potential Source 1: AST ; Distance from well to Potential Source 1: ~12 m
Potential Source 2: Industrial Junkyard ; Distance from well to Potential Source 2: ~20m
Potential Source 3: Scrap Metal ; Distance from well to Potential Source 3: ~20m
Potential Source 4: _____ ; Distance from well to Potential Source 4: _____

t. Are there other wells on this property? ☐ Yes ☐ No

How many? _____ ☐ in use ☐ abandoned ☐ require proper sealing

2. Well and Wellhead information:

a. When was well installed? Year 1975 Month November

b. Type: ☒ drilled ☐ dug ☐ sand point ☐ other _____

c. Is there a drillers log for the well: ☒ Yes ☐ No

d. Is there a surface seal to 6 m ☐ Yes ☒ No ☐ unknown ☐ unlikely

e. Surface casing: ☐ Yes Diameter _____ ☒ No

f. Well casing: Diameter 15cm Material: ☒ steel ☐ plastic ☐ concrete

g. Depth of well: 75 ft ☐ measured (if possible) ☐ reported ☐ from log

h. Static water level below ground: unknown

☐ measured (if possible) ☐ reported ☐ from log ☐ flowing

i. (If granular) Is the well completed: ☐ open end casing ☐ with a well screen

☐ with slotted pipe ☐ unknown other perforated pipe - bottom closed

j. (If bedrock) Does the well have a liner? ☐ yes ☐ No ☐ steel ☐ plastic

k. If there is a well screen: length 5 ft slot size(s) perforated
Location of screen: from 68 ft to 73 ft (from log) reported

l. Is there a sump below the screen? ☐ Yes ☐ No unknown

m. Is the well head: ☐ in pumphouse ☒ in pit ☐ pitless adaptor ☐ in a building
ø 110cm fibreglass culvert

☐ in a wooden enclosure other, describe _____

n. If the well head is located in a wooden enclosure,

i. Is the well head below grade? describe in detail 2.5m below grade

ii. Are there signs of ponding on the enclosure(e.g. water stains, etc.)? ☐ Yes ☒ No

iii. Is the wellhead enclosed by fiberglass insulations? ☒ Yes ☐ No

iv. Any evidence of rodents? Specify No

v. Does the well casing have a proper seal cap? ☐ Yes ☒ No

If no, describe condition seal cap is not on well - has been removed well is open

3. Water Supplying This Well:

a. By definition is the water from a surface water source or under the direct influence of surface water?

☒ Yes ☐ No ☐ farther investigation required.

If yes is there treatment ☒ Yes ☐ No

Explain (filtration, disinfection etc...) Softener, fitration, RO

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4. Aquifer Supplying This Well:

a. The aquifer is: ☐ bedrock ☒ granular sediment ☐ unknown

b. Does water level and/or well capacity show seasonal fluctuation? ☐ Yes ☒ No unlikely

5. Pump Installation:

a. Is the well equipped with a pump? ☒ yes ☐ No

b. Type of pump: ☐ hand ☒ electric submersible ☐ jet

☐ shallow well centrifugal ☐ other, _____

c. Description: Manufacturer _____ Model _____

horsepower _____ capacity _____ voltage _____

d. Date installed: _____ By: _____

e. For submersible pump, depth of setting below surface _____

f. Drop pipe for submersible pump: ☐ steel ☒ plastic likely

g. Pump delivers water to: ☒ pressure tank ☐ elevated tank ☐ other

h. Are there automatic pump controls: ☒ Yes ☐ No

i. Is there provision for taking water samples before water reaches storage? ☐ Yes ☒ No

j. Is there a water meter on the system? ☒ Yes ☐ No

k. Is the pump and piping protected from freezing? ☒ Yes ☐ No

If yes, describe: Insulation -> There may be heat trace

l. Comments on pump installation: _____

6. Conclusions

a. Comments on overall installation:

There was no salt in softener at time of inspection.
The wellhead has no cap on it and well is open.

b. Recommendations: _____

PART B: EBA Site Inspection

Inspector: BERT ALBISSER Date JUNE 21/05

WELL ID #	Owner	Location Description
4981	YTG	WATSON LAKE EWR-

6. **Water Treatment**

a. Is well water treated? ☑ Yes ☐ No; Type of treatment: AMG, WS, RO.

☐ chlorination ☐ iron and or manganese removal ☐ other _____

b. Is water entering plumbing or piped distribution system treated with chlorine or another treatment that is as effective as chlorine used to achieve disinfection throughout the system?

☐ Yes ☑ No If so how _____

c. If treated with chlorine, is the free residual chlorine concentration less than 0.2 mg/L

☐ Yes ☐ No _____ reading.

Tested at _____(location)

d. Is testing for chlorine residual concentration done at the tap (eg. Kitchen faucet) or from representative points in a piped distribution system, including a point from tap at the end line

☐ Yes ☐ No If yes how often? _____

e. If the drinking water is being transported by water delivery truck does it have a minimum chlorine free residual of 0.4 mg/L at the time of fill. ☐ Yes ☐ No

7. **Water Quality (observations):**

a. Does the water stain plumbing? ☐ yes ☑ No ☐ slight ☐ severe

Type of stain: ☐ brown ☐ red ☐ black

b. Does the water contain sediment? ☐ Yes ☑ No ☐ occasional ☐ constant

c. Is there an unpleasant odour? ☐ Yes ☑ No ☐ H_2S ☐ Other _____

d. Is there an unpleasant taste? ☐Yes ☑No ☐brackish ☐ Other _____

e. Is there a history of bad bacterial analyses? ☐ Yes ☐ No

f. Is there a chemical analysis? ☐ Yes ☐ No ☐adequate ☐ incomplete

g. Is there analysis of trihalomethanes (THMs) where the water source is a surface water supply or a well under the direct influence of surface water? ☐ Yes ☐ No

h. Is the drinking water tested daily with an accurate reading chlorine test kit capable of reading in the range 0 to 3.5 mg/L of free chlorine residual in increments of 0.1mg/L? ☐ Yes ☐ No ☐ unknown

i. If yes is the test performed in accordance with manufactures directions? ☐ Yes ☐ No ☐ unknown

j. Is a record of the date, time,name of person performing the test and results of the drinking water sample kept? ☐ Yes ☐ No

TANK AND PIPING DETAILS

Tank Room

Is there a water tank? Yes No Details:

Where is it located?
Comments: _____

Is the room in which the water tank is located heated to maintain an optimum temperature of 4°C for stored water?
YES NO
Comments:_____

Are there windows in the add-on that may allow direct sunlight onto the water holding tank? YES NO

Comments: _____

Are there other heat sources near the tank? YES NO
Comments: _____

Is there waterproof flooring with a sealed base to contain spills? YES NO
Comments: _____

Overall Tank

What are the tank size and dimensions?

_____

What material is the tank constructed of? _____

Is tank and associated piping constructed of safe materials (i.e. CSA approved and material that does not affect the taste of the water)? YES NO

Comments: _____

Tank Inlet, Outlet and Lid

Is there adequate access on the tank for cleaning (i.e. min 15" access lid)? YES NO

Does the lid have a tight seal and is it watertight when closed? YES NO

Does the tank have an overflow or high level whistle? YES NO

Is the water tank drain accessible? YES NO

WATER TANK AND WATER QUALITY CONDITION

Are there signs of staining or biofouling? YES NO
Comments: _____

Is there any sediment or scum in bottom of tank? YES NO
Comments: _____

Is there any odour associated with the water or tank? YES NO

Have there been any bacteriological analyses conducted previously? YES NO

Does the tank appear that it has been cleaned recently? YES NO

Are the tanks easily assessed for the purpose of cleaning and disinfection? YES NO

8. Conclusions

a. Comments on overall installation:

GOOD OVERALL INSTALLATION. HOWEVER AUTOMATIC FILTER DRAINS & RO DRAINS ARE SUBJECT TO CROSS CONTAMINATION.

b. Recommendations:

INSTALL AIR GAP TO SOFTNER & RO DRAINS.
INSTITUTE BI ANNUAL SUPER CHLORINATION OF WELL & PIPING SYSTEM. INSTALL ~~AN OR~~ APPROPRIATE UV SYSTEM AFTER SOFTENER.

MIDNIGHT SUN DRILLING CO. LTD.
PH: 668-2434
WHITEHORSE Y.T.
P.O. Box 4391

FIELD REPORT

Started. NOV. 12 ..... 19 75
Completed. NOV 15 ..... 19 75

NAME AND ADDRESS OF CLIENT	DESCRIPTION OF WORK	LOCATION OF WORK
INDIAN AFFAIRS	WATER WELL	WATSON LAKE Mining Recording Office

FORMATION LOG

FROM	TO	FORMATION
0	16	BROWN SY, SD
5	50	SY, SD
50	60	GR + SD
60	75	GR + SD

DESCRIPTION OF WORK

MOVE

DATE	TIME FROM	TIME TO	HOURS
NOV 12	~~8~~	8/930	12.5
NOV 13	~~8~~	8/9	12 X
NOV 14	~~8~~	8 7	11
NOV 15	~~8~~	8/7	11

HR.

Casing & Pipe

Type	Size	Type
Inch	Feet	Inch
2"		
6		
6"		
0		
8"		
0"		
8"		

Remarks:

BOTTOM CLOSED
PER 68' TO 73'

BAILED AT 5 GALS
10 HRS. BAILING

STATIC LEVEL		Total Rig Time	46.5 hrs.
Ground level		Total Standby	hrs.
Top of casing		Drilling Mud	4 sacks

SIGNATURES

MIDNIGHT SUN.. M. FRY ..... TULL .....
TITLE..... DRILLER .....

CLIENT.....
TITLE.....

Photo 0270: 4981 Wellhead enclosure (front), and EMR office (behind)

Photo 0269: 4981 Wellhead in pit

Photo 0272: 4981 Above ground fuel storage tank (right), EMR office (behind), and septic field (back left)

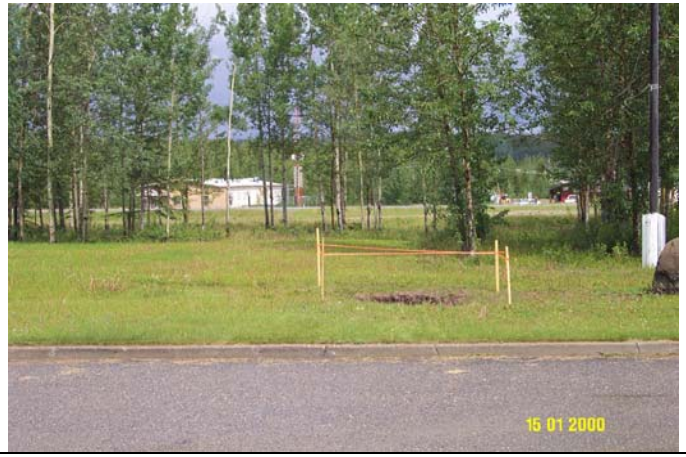

Photo 0267: 4981 Sinkhole – could be abandoned septic tank

Photo 0012: 4981 AMG filter

Photo 0013: 4981 Water softener

Photo 0011: 4981 Reverse osmosis system

Photo 0009: 4981 Pressure Tank