Hydrogeological Site Characterization at Brown McDade Pit, Mt. Nansen

Prepared for

Yukon Government, Energy, Mines and Resources
Abandoned Mines Project Office

Submitted by

Gartner Lee Limited

March 2008

Gartner Lee

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Prepared for

Yukon Government,
Energy, Mines and Resources
Abandoned Mines Office

March 2008

Reference: **GLL 70-803**

Distribution:

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March 20, 2008

Hugh Copland
Project Manager
Assessment and Abandoned Mines Branch
Energy, Mines and Resources Government of Yukon
PO Box 2703 (K-419)
Suite 210 – 419 Range Road
Whitehorse, YT Y1A 2C6

Dear Mr. Copland:

Re: GLL 70803 – Hydrogeological Site Characterization at Brown McDade Pit, Mt. Nansen

We are pleased to submit this final report detailing results from the installation of three groundwater monitoring wells, the completion of a water elevation survey, and the collection of water quality samples within the vicinity of the Brown McDade Pit. This work follows previous investigations conducted in early 2007 and is intended to address recommendations outlined in a previous report prepared by Gartner Lee, "GLL 70-103 – Mt. Nansen Mine Site, Brown McDade Pit Desktop Hydrogeological Study".

If you have any questions concerning this report, please do not hesitate to contact me at (867) 633-6474 x 5727.

Yours very truly,
GARTNER LEE LIMITED

Jonathan Kerr, M.Sc., P.Geo.
Senior Hydrogeologist

JK:JF:sg

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Gartner Lee Limited

March 31, 2008

Hugh Copland
Project Manager
Assessment and Abandoned Mines Branch
Energy, Mines and Resources Government of Yukon
PO Box 2703 (K-419)
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Whitehorse, YT Y1A 2C6

Dear Mr. Copland:

Re: GLL 70803 – Hydrogeological Site Characterization at Brown McDade Pit, Mt. Nansen – Final Report Typo Error Correction

On March 31, 2008, it was brought to the attention of Gartner Lee Limited (GLL) that a typo was identified in Table 4 and Section 3.4 of the Final Report (identified above). This report was first issued to you on March 20th, 2008. This letter is provided for your records to indicate that GLL has subsequently corrected this error. The report herein includes this change. In no way does this correction effect the recommendations or conclusions associated with the report.

If you have any questions concerning this report, please do not hesitate to contact me at (867) 633-6474 x 5727.

Yours very truly,
GARTNER LEE LIMITED

Jonathan Kerr, M.Sc., P.Geo.
Senior Hydrogeologist

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1. Study Objectives

In the vicinity of the Brown McDade pit, the objectives of the current study are to:

- Further validate the Conceptual Groundwater Flow Model developed for the site (GLL 2007).
- Determine possible contaminant migration flow direction and groundwater quality.
- Provide an increased level of understanding for the potential of environmental impacts to critical surface water receptors.

2. Background

The Gartner Lee (May 2007) report, entitled "Mt. Nansen Mine Site, Brown McDade Pit Desktop Hydrogeological Study" assessed the fate of poor water quality leaving the Brown McDade Pit through the development of a Conceptual Groundwater/Surface Water Flow Model. In part, this study suggested that seepage leaving the Brown McDade Pit likely reports to a bedrock aquifer system, which eventually recharges the down valley surface water system (GLL 2007), through the unconsolidated fluvial deposits.

Current study objectives are to further validate this Conceptual Model through the incorporation of field investigations. This letter report details results from a drilling program conducted in November 2007, discusses water elevation and water quality results, and assesses the potential of environmental impacts to critical surface water receptors.

3. Results

3.1 2007 Drilling Program

Three groundwater monitoring wells were drilled by Encore Coring & Drilling of Whitehorse, on November 25 and 26, 2007, within the vicinity of the Brown McDade Pit. Each well was drilled using a track mounted Air Rotary drill using 6" steel casing, with the bottom portion of the monitoring well drilled 'open-hole' through bedrock. Geological interpretive logs for each well and photos of field activities are presented in Appendices A and B respectively. Grab samples from each borehole were taken in two foot increments and labelled by the onsite field Hydrogeologist. Appendix C provides a photo log of the samples organized in chip-trays with the corresponding depth noted.

The monitoring wells have been labelled and identified as, GLL07-01, GLL07-02, and GLL07-03. A summary of the well completion details are provided in Table 1. Relative site locations of each groundwater monitoring well are shown on Figure 1.

Table 1. Summary of Well Completion Details

Parameter	Monitoring Well ID		
	GLL07-01	GLL07-02	GLL07-03
Stick-up (m)	1.14	1.44	1.03
Depth to Bottom (mbTOC)	19.43	7.54	11.39
Open-hole Interval (mbTOC)	10.39-19.43	4.34-7.54	9.56-11.39
TOC Elevation (masl)[1]	1213.69	1186.67	1187.90
BOW Elevation (masl)	1194.26	1179.13	1176.51
Static water level on Nov. 23, 2007 (mbTOC)	dry	dry	5.87

Notes:
mbTOC = metres below top of casing
BOW = bottom of well
[1] Measured by GLL 2007 using Thales Promark 3 GPS unit.

GLL07-01

This monitoring well is located on the upper bench, north of the pit. The well was completed to a total depth of 18.29 mbgs (metres below ground surface), with 9.04 m drilled as 'open-hole'. Water was not encountered in GLL07-01.

The termination depth was based on calculations performed to avoid drilling through an inferred local fault in the vicinity of the pit. The fault (Figure 1.), as inferred by BYG Natural Resources Inc., is found to dip between 50 and 70 degrees to the southwest (GLL 2007). As noted by BYG (1994) it is believed that the gouge and alteration associated with this footwall fault provides a low permeability groundwater boundary, which may reduce or cut off groundwater flow across/orthogonal to the fault zone (BYG 1994). Therefore, drilling through the fault could provide a pathway for groundwater to 'short circuit' beyond this geological boundary and discharge to Pony Creek, likely at some point further downstream. Therefore, a simple trigonometric calculation was performed prior to drilling, in order to determine an approximate drilling termination depth (19.5 m), using the conservative fault dip angle of 50 degrees. The well was completed at 19.43 mbTOC.

GLL07-02

GLL07-02 is located adjacent to the portal entrance and immediately south of Pony Creek. The well was completed to a depth of 6.10 mbgs with 3.2 m drilled 'open-hole'.

GLL07-03

This well was drilled to a depth of 10.36 m with 1.83 m left as 'open hole'. The well is located in the pit at the bottom of the access ramp.

Both wells GLL07-01 and GLL07-02 were found to be dry; however, this has provided important information in determining the local groundwater flow regime (Figure 1.). Well GLL07-03 had a measured static groundwater level of 5.87 mbTOC (metres below top of casing).

3.2 Groundwater/Surface Water Elevation Survey

On November 23, 2007 Gartner Lee conducted a water elevation survey within the vicinity of the Brown McDade Pit, using a Thales Promark 3 GPS unit. The top of casing (TOC) of each groundwater monitoring well was surveyed. Using this information, remaining well construction elevations were calculated (Table 1), including the groundwater elevation at GLL07-03. In addition, the pit lake water elevation was surveyed (access gained via ice auger), as well as a stream profile conducted along a reach of Pony Creek north of the pit. Qualitative observations were also conducted at the adits north of the pit. The west adit was noted to be dry, while the east adit contained a small quantity of frozen ponded water with an icycle formation at the rear of the adit (Appendix B).

Key surface water and groundwater elevations were calculated and used to determine the hydrogeological flow regime for the local study area as shown in Figure 1. (plan view). Figure 2. illustrates the groundwater and surface water elevations in cross-section, with the relative monitoring well completion detail elevations shown. It should be noted that GLL07-02 did not lie on the cross-sectional plane taken through the centre of the pit, and was hence projected 183 m (from the portal entrance adjacent Pony Creek) onto the diagram. Data from this field investigation is consistent with the “Conceptual Model” developed by GLL, 2007.

3.3 Water Quality Results

Water quality samples were collected on November 23, 2007. A groundwater sample was obtained from GLL07-03 (GLL07-01 and GLL07-02 wells were dry) and a surface water sample collected from the pit lake surface (sample ID “Pit North End”). Field measurements of pH, specific conductance, and temperature were recorded. Each sample was analyzed for dissolved metals and for general chemistry parameters including pH, hardness, conductivity, alkalinity (total bicarbonate, carbonate, hydroxide, phenolphthalein), sulphate, and nitrate nitrogen. ALS Environmental of Vancouver, BC, a member of the Canadian Association for Environmental Analytical Laboratories (CAEAL), conducted all water analyses. The original laboratory report for chemical analysis is contained in Appendix D. Water quality results were compared to CCME Aquatic Life Standards as shown in Table 2. Table 3 provides a summary of CCME Guideline exceedances.

Table 2. Mt. Nansen Water Quality Results, November 2007

Station		Detection Limits	Water Quality Guidelines	GLL07-03	PIT NORTH END
Date		ALS	CCME [a]	23-Nov-07	23-Nov-07
Physical Tests					
	pH (Field)	-		6.60	-
	Conductivity, uS/cm (Field)	-		1500	-
	Temperature (Field)	-		1.2	-
	pH (Lab)	0.01	6.5-9.0	6.77	7.97
	Conductivity, uS/cm (Lab)	2		1560	1340
	Hardness (as CaCO3)	0.7		912	802
Anions and Nutrients					
	Alkalinity, Bicarbonate (as CaCO3)	2		73.8	153
	Alkalinity, Carbonate (as CaCO3)	2		<2.0	<2.0
	Alkalinity, Hydroxide (as CaCO3)	2		<2.0	<2.0
	Alkalinity, Total (as CaCO3)	2		73.8	153
	Sulfate (SO4)	10		866	654
	Nitrate (as N)	0.1	13	3.72	0.846
Dissolved Metals					
	Aluminum (Al)-Dissolved	0.025	0.005-0.1[b]	0.091	<0.025
	Antimony (Sb)-Dissolved	0.0025		<0.0025	0.0092
	Arsenic (As)-Dissolved	0.0025	0.005	<0.0025	*0.014*
	Barium (Ba)-Dissolved	0.02		<0.020	<0.020
	Beryllium (Be)-Dissolved	0.005		<0.0050	<0.0050
	Boron (B)-Dissolved	0.1		<0.10	<0.10
	Cadmium (Cd)-Dissolved	0.000085	0.000017	*0.227*	*0.0022*
	Calcium (Ca)-Dissolved	0.1		264	220
	Chromium (Cr)-Dissolved	0.005	0.001	<0.0010	<0.0010
	Cobalt (Co)-Dissolved	0.0015		0.0081	<0.0015
	Copper (Cu)-Dissolved	0.005	0.002-0.004[c]	*0.127*	*0.0123*
	Iron (Fe)-Dissolved	0.03	0.3	*7.78*	<0.030
	Lead (Pb)-Dissolved	0.0025	0.001-0.007[d]	<0.0025	<0.0025
	Lithium (Li)-Dissolved	0.025		<0.025	<0.025
	Magnesium (Mg)-Dissolved	0.1		61.5	61.6
	Manganese (Mn)-Dissolved	0.0015		8.29	0.0627
	Mercury (Hg)-Dissolved	0.00002	0.000026	<0.000020	<0.000020
	Molybdenum (Mo)-Dissolved	0.005	0.073	<0.0050	<0.0050
	Nickel (Ni)-Dissolved	0.005	0.025-0.15[e]	0.0331	<0.0050
	Potassium (K)-Dissolved	2		2.6	2.2
	Selenium (Se)-Dissolved	0.005	0.001	<0.0010	<0.0010
	Silver (Ag)-Dissolved	0.0001	0.0001	<0.00010	<0.00010
	Sodium (Na)-Dissolved	2		7	8.3
	Thallium (Tl)-Dissolved	0.001	0.0008	<0.00020	<0.00020
	Tin (Sn)-Dissolved	0.0025		<0.0025	<0.0025
	Titanium (Ti)-Dissolved	0.01		<0.010	<0.010
	Uranium (U)-Dissolved	0.001		<0.0010	0.0033
	Vanadium (V)-Dissolved	0.005		<0.0050	<0.0050
	Zinc (Zn)-Dissolved	0.005	0.03	*15.5*	*0.377*

Notes:

All units mg/l unless otherwise noted.

a) Canadian water quality guidelines for the protection of aquatic life, Council of Ministers of the Environment, December 2007.

b) 0.005 mg/L at pH <6.5, [Ca2+] <4 mg/L, DOC <2 mg/L: 0.1 mg/L at pH ≥6.5, [Ca2+] ≥4 mg/L, DOC ≥2 mg/L.

c) 0.002 mg/L at [CaCO3] = 0 - 120 mg/L; 0.003 mg/L at [CaCO3] =120 - 180 mg/L; 0.004 mg/L at [CaCO3] >180 mg/L.

d) 0.001 mg/L at [CaCO3] = 0 - 60 mg/L; 0.002 mg/L at [CaCO3] =60 - 120 mg/L; 0.004 mg/L at [CaCO3] =120 -180 mg/L; 0.007 mg/L at [CaCO3] > 180 mg/L.

e) 0.025 mg/L at [CaCO3] = 0 - 60 mg/L; 0.065 mg/L at [CaCO3] =60 - 120 mg/L; 0.110 mg/L at [CaCO3] =120 -180 mg/L; 0.150 mg/L at [CaCO3] > 180 mg/L.

Italic *Results exceed CCME Aquatic Life Guidelines.*

Table 3. Summary of CCME Aquatic Life Standard Exceedances

Parameter	CCME Guideline[a] (mg/L)	Station ID	
		GLL07-03 (mg/L)	Pit North End (mg/L)
Arsenic	0.0025	-	0.014
Cadmium	0.000085	0.227	0.0022
Copper	0.005	0.127	0.0123
Iron	0.03	7.78	-
Zinc	0.03	15.5	0.377

Notes:

[a] *Canadian water quality guidelines for the protection of aquatic life, Council of Ministers of the Environment, December 2007.*

3.4 Hydraulic Conductivity Analysis

Hydraulic conductivity measurements of the massive granodiorite bedrock (BYG, 1994) located at the bottom of the pit were developed using three different methods. All three methods applied the measured hydraulic gradient of 0.043 (measured from the static water elevation GLL07-03 and the North Pit) and a porosity of 0.05 for crystalline rock (Freeze and Cherry 1979). The first method was based on an estimated hydraulic conductivity of $1x10^{-7}$ m/s (GLL 2007). Using the Darcy Equation this information was used to calculate an estimated travel time of 5 years from the pit to Dome Creek.

Two additional analytical methods were applied to further characterize the bedrock hydraulic conductivity. A short duration constant rate pumping test and recovery test were conducted at GLL07-03. The estimated hydraulic conductivities and groundwater travel times are provided in Table 4. Appendix E provides a summary of the raw data.

Table 4. Estimated Groundwater Travel Times to Dome Creek

Analysis Method	Parameters	Estimated K (m/s)	Travel Time (years)
Conceptual Hydrogeological Flow Model	Based on measured seepage out of pit (GLL 2007).	1.0×10^{-7}	479
Hvorslev - Constant Head Method (University of Waterloo, 2004)	Based on constant rate test at GLL07-03.	1.5×10^{-6}	32
Hvorslev - Rising Head Method (Aquifer Test, v.3.0.)	Based on rising head test at GLL07-03.	2.7×10^{-6}	18

Notes:

1. *Closest distance from North Pit to Dome Creek approximately 1300 m.*
2. *Hydraulic gradient assumed constant at 0.043 from North Pit to Dome Creek.*
3. *Porosity of 0.05 used for crystalline rock (Freeze and Cherry 1979).*

For constant head interpretation, the following (Hvorslev) formula was applied:

$$K = \frac{Q \ln(2L / D)}{2\pi L H_c}$$

where K = hydraulic conductivity
Q = pumping rate (9.259×10^{-6} m^3/s)
L = screen length or 'open-hole' portion of borehole (1.829 m)
D = well diameter (0.1524 m)
H_c = constant drawdown amount during pumping (1.69 m)

For rising head interpretation, the data was processed using AquiferTest V.3.0. (Waterloo Hydrogeologic Inc., 2001).

4. Key Findings

The following four key findings are:

- The Conceptual Flow Model developed for the site (GLL 2007) was validated through the completion of three monitoring wells and a subsequent groundwater/surface water elevation survey. It was confirmed that the groundwater gradient in the vicinity of the pit suggests that pit seepage water is moving to the south towards the Dome Creek drainage basin.
- The west adit located at the north end of the pit was noted to be dry during the October 2007 site visit. Bruce Wheeler (mine caretaker) informed the onsite Hydrogeologist of this rare occurrence. It is suspected that an usually wet summer may have diverted seepage away from the pit through excess sediment possibly blocking fracture connectivity from Pony Creek to the adit or to the rim of the North Pit wall.
- Groundwater travel times from the North Pit to Dome Creek are estimated to be on the order of 18 to 479 years.
- Poor water quality was confirmed within the pit lake and within the shallow bedrock underlying the pit. It is difficult to determine where the flow paths leaving the pit will inevitably daylight given the known complexities associated with bedrock fractured flow and groundwater/surface water flow interactions in the unconsolidated down valley sediments (GLL 2007).

5. Recommendations

The following provides an overview of the recommendations:

- The steady state pit water elevation is estimated at approximately 1,185 mASL (GLL 2007). It is recommended that the pit not be pumped out and that the pit water elevation be monitored to confirm pit water elevation predictions.
- A biannual site monitoring program is recommended for the 2008 season, including:
    - Static water level measurements at all three monitoring wells. If GLL07-01 and/or GLL07-02 are found to contain water, a groundwater sample should be obtained in order to provide water quality data at these locations.
    - Qualitative observations conducted at the north pit adit locations (east and west adits), noting any changes to the presence/absence/rate of seepage.
    - Installation of a levelogger transducer in GLL07-03 to provide transient groundwater gradient information. Pit water elevation measurements should be combined with this information to provide an assessment of seasonal groundwater gradients and flow directions in the vicinity of the pit.

6. Closure

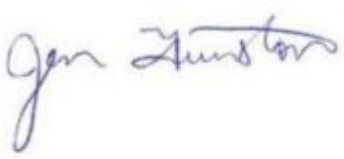
This report was prepared for Government of Yukon, Energy Mines and Resources, Abandoned Mines Project Office. The report, which specifically includes all text, tables, figures, and appendices, is based on data and information collected during the investigations conducted by Gartner Lee Limited, and is based solely on the conditions of the site at the time of the investigation, supplemented by previous information and data obtained by Gartner Lee Limited, as described in this report.

The work described in this report, were conducted in a manner consistent with that level of care and skill normally exercised by other members of the engineering and science professions currently practicing under similar conditions, subject to the time limits and financial and physical constraints applicable to the services.

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

If you have any questions regarding the contents of this report do not hesitate to contact Jonathan Kerr at 867-633-6474 ext. 5727.

Report Prepared By:



Jennifer Funston, B.Sc.
Hydrogeologist

Report Reviewed By:

Jonathan Kerr, M.Sc., P.Geo.
Senior Hydrogeologist

7. References

Bruce Wheeler (personal communication, October 2007).

BYG Natural Resources Inc. 1994.

Canadian Council of Ministers of the Environment. 2007. Canadian water quality guidelines for the Protection of aquatic life: Summary table. Updated December 2007.

Cherry, John A. and R. Allan Freeze. Groundwater. Prentice-Hall, Inc., Englewood Cliffs, N.J. 1979.

Gartner Lee Limited. 2007. GLL 70-103 – Mt. Nansen Mine Site, Brown McDade Pit Desktop Hydrogeological Study. Prepared for Energy, Mines and Resources, Abandoned Mines Project Office. May 2007.

University of Waterloo. 2004. Earth 458: Physical Hydrogeology Lab Manual.

Waterloo Hydrogeologic Inc., 2001:
WHI AquiferTest Version 3.0. Software. Waterloo, Ontario.

Figures

Date Revised: month dd, yyyy Revision: 0

Date Plotted: February 7, 2008 File Location: E:\GIS\GIS_proj\Y2007\Mt_Nansen\70803_forWhitehorse\70803_By1_01_HydrogeoI_Feb08.dwg

BERMS

PC3
EL. 1213.538m

PC2
EL. 1210.218m

PC1
EL. 1207.089m

GLL07-01
EL. < 1194.3m

PC4
EL. 1200.480m

GLL07-02
EL. <1179.1m

PONY CREEK ADIT
EL. 1183.43m

PONY CREEK ADIT
EL. +/- 1185m

North Pit
EL. 1184.651m

POND

PIT LAKE
EL. 1184.7m ASL
(NOV. 2007)

EL. 1183.811m

GLL07-03
EL. 1182.034m

FOOTWALL
FAULT

WASTE ROCK DUMPS

ACCESS RAMP

SOUTH PIT

Key Map

Map Sources / Notes:
- Topographic data by The Orthoshop, based on 1998 aerial photography at 1:50,000 scale
- Brown McDade pit survey by Underhill Geomatics, Ltd., Drawing 281-05B dated 18 March, 2003
- NTS Map Sheet 115 I/03

0 5 10 20 30 40 m

1 : 1000
UTM Zone 8N, NAD83

File Name: 70803_By1_01_Hydrogeol_Feb08.dwg
Reviewed by: JF Prepared by: AL
Date Issued: Feb, 2008 Project Number: 70-803

Legend

- Building
- Road / Trail
- Inferred Fault (By B.Y.G. Natural Resources Inc.)
- Inferred Groundwater Flow Direction
- Inferred Groundwater Contour (m)
- Survey Point - 2007 Gartner Lee Limited
- Contour - Major 5m
- Contour - Minor 1m
- Drainage
- Lake / Pond
- Existing Berm

* Pony Creek is interpreted as a perched feature (i.e. surface water level in Creek is not the interpreted groundwater table shown).
** Interpretation is based on field measurements (groundwater measurements at 3 locations and surface water measurements at 2 locations within the pit).

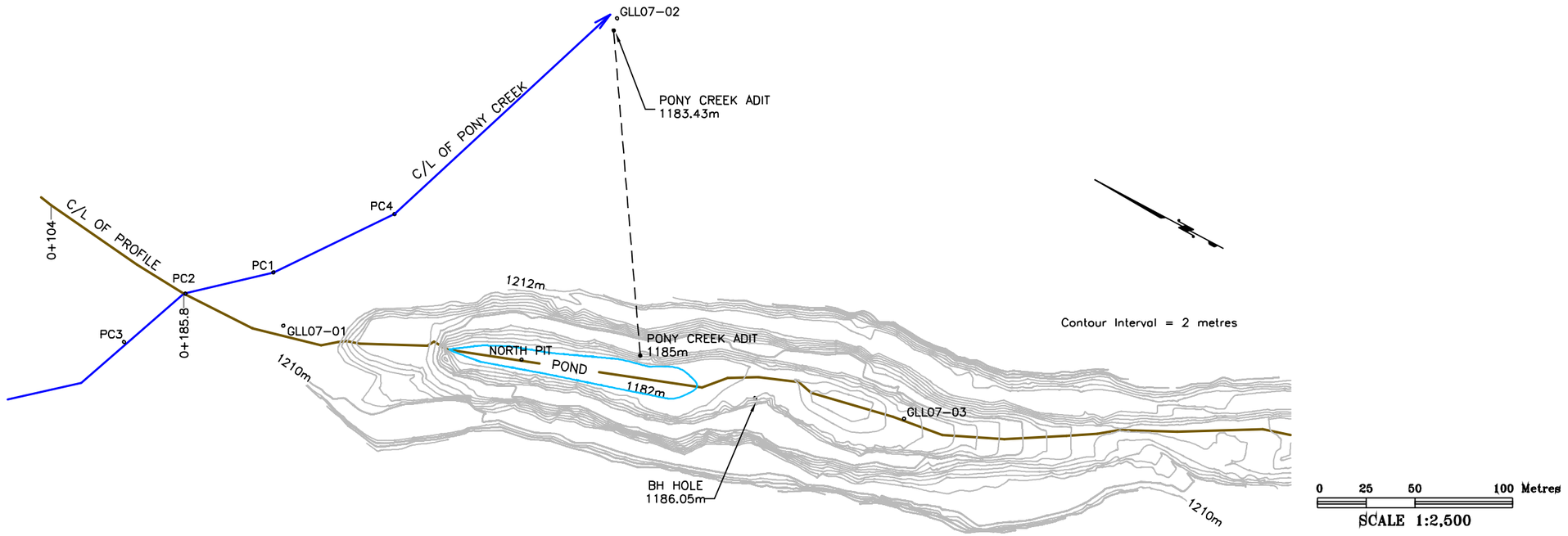
Yukon Territorial Government

Mt. Nansen Mine
Location: Near Carmacks, Yukon

Interpreted Local Groundwater Contour Map

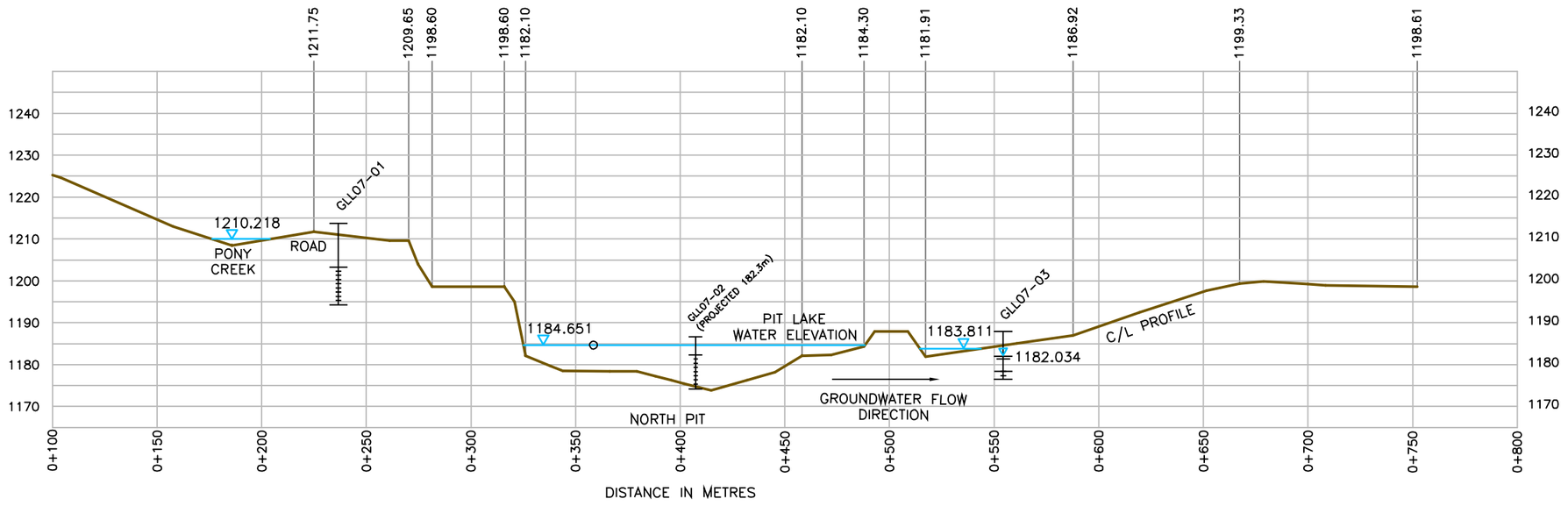
Gartner Lee

Figure 1
Version 1



PLAN VIEW

PROFILE



LEGEND:

GLL07–01	Well ID
1187.904	TOC Elevation (masl)
1182.034	Water Level Elevation
	Open Portion of Monitoring Well
1175.511	Bottom of Well Elevation
o	Pit Lake Sample Location

*All Surface Water (SW) and Groundwater (GW) Elevations Taken on: November 23, 2007

SOURCE OF DRAWING:
SURVEY BY UNDERHILL SURVEYORS CONDUCTED IN MARCH, 2004

(SPOT ELEVATIONS OF SW, GW AND MONITORING WELL TOC'S TAKEN BY GLL 2007 USING THALES PROMARK 3 GPS UNIT)

CONTOURS IN mASL NAD 83 ZONE 8

REVIEWED BY:	JK
DRAWN BY:	KW
DATE ISSUED:	JANUARY, 2008
PROJECT NUMBER:	70803
FILE NAME:	70803–2D–02.DWG
REVISION:	0

Project: HYDROGEOLOGICAL SITE CHARACTERIZATION AT BROWN MCDADE PIT, MT. NANSEN
Location: MT. NANSEN MINE SITE, BROWN MCDADE PIT
Client: ENERGY MINES AND RESOURCES, ABANDONED MINES OFFICE

PROFILE OF WATER ELEVATIONS IN PIT

Gartner Lee

Figure No. 2

Appendices

Appendix A

Geological Interpretive Logs

BOREHOLE LOG	**PROJECT:** 70803	**BOREHOLE:** GLL07-01 1 of 1
Mt. Nansen Mt. Nansen, yukon **FOR:** YTG Energy, Mines and Resources, Abandoned Mines Project Office		**DATE:** 26 October 2007 **LOGGED BY** JK **GROUND ELEV** 1212.55m ASL

DEPTH (m)	STRATIGRAPHY	STRATIGRAPHIC DESCRIPTION	MONITOR DETAILS & NUMBER	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE N VALUE	SAMPLE % WATER	SAMPLE % REC	SAMPLE % RQD	COMMENTS
0.0		Light grey coarse GRAVEL, some sand.									UTM 388851.923 W 6881778.708 N Elevation (TOC) 1213.69 mASL
0.9						GS					
1		Silty medium brown ORGANIC HORIZON				GS					
1.5		BEDROCK, weathered				GS					
2						GS					
3						GS					
4						GS					
4.3		BEDROCK				GS					
5		- dark yellowish orange at 4.27 m - light grey between 4.88 and 6.1 m				GS					
6						GS					
7		- tan coloured between 6.7 and 8.53 m				GS					
8						GS					
9						GS					
10		- grey at 9.14 m - yellowish orange at 9.75 m				GS					
11		- tan coloured at 10.36 m - becoming yellowish grey and slightly weathered between 10.97 and 11.58 m				GS					
12						GS					
12.8		- moderate competency and yellowish grey at 12.19 m				GS					
13		Highly weathered BEDROCK - light yellowish grey between 12.8 and 13.41 m				GS					
14						GS					
15		- dark yellowish grey between 14.02 and 14.63 m				GS					
16		- light grey between 15.24 and 16.46 m				GS					
17						GS					
18		- tan coloured between 17.07 and 18.23 m				GS					
18.3						GS					
19		Borehole terminated at 18.29 m									

BOREHOLE LOG	**PROJECT:** 70803	**BOREHOLE:** GLL07-02 1 of 1
Mt. Nansen Mt. Nansen, yukon **FOR:** YTG Energy, Mines and Resources, Abandoned Mines Project Office		**DATE:** 26 October 2007 **LOGGED BY** JK **GROUND ELEV** 1185.23m ASL

DEPTH (m)	STRATIGRAPHY	STRATIGRAPHIC DESCRIPTION	MONITOR DETAILS & NUMBER	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE N VALUE	SAMPLE % WATER	SAMPLE % REC	SAMPLE % RQD	COMMENTS
0		Light grey coarse GRAVEL, with some sand				GS					UTM 389071.055 W 6881702.619 N
1						GS					
1.5		Sandy silt to silt brown ORGANIC HORIZON				GS					
2						GS					Elevation (TOC) 1186.67 mASL
2.7		Moderately competant, tan coloured BEDROCK				GS					
3						GS					
4						GS					
4.6		Weathered, light tan coloured BEDROCK				GS					
5						GS					
6.1						GS					
6						GS					
7		Borehole terminated at 6.1 m									

BOREHOLE LOG	**PROJECT:** 70803	**BOREHOLE:** GLL07-03 1 of 1
Mt. Nansen Mt. Nansen, yukon **FOR:** YTG Energy, Mines and Resources, Abandoned Mines Project Office		**DATE:** 25 October 2007 **LOGGED BY** JK **GROUND ELEV** 1186.87m ASL

DEPTH (m)	STRATIGRAPHY	STRATIGRAPHIC DESCRIPTION	MONITOR DETAILS & NUMBER	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE N VALUE	SAMPLE % WATER	SAMPLE % REC	SAMPLE % RQD	COMMENTS
0		Weathered BEDROCK									UTM 388960.200 W 6881476.290 N
1		- highly weathered - light brwon grading to light orange				GS					
2						GS					Elevation (TOC) 1187.90 mASL
3		- dark to medium yellowish-orange				GS					
4						GS					
4.6						GS					
5		Compentent BEDROCK - yellowish orange				GS					
6		-dark yellowish orange				GS					
7		- light yellowish orange				GS					
8		- light grey				GS					
9						GS					
10		- becoming highly competent				GS					
10.4						GS					
11		Borehole terminated at 10.36 m									

Appendix B

Photo Log – Field Activities

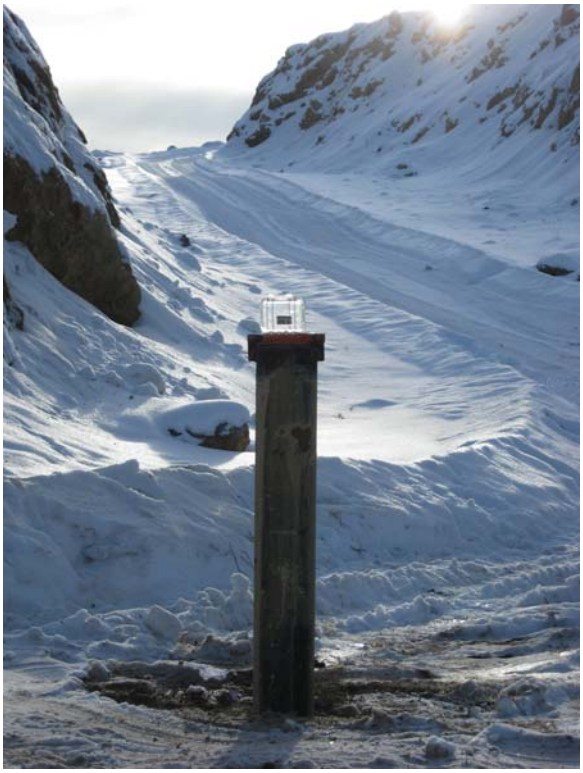
Photograph 1. Drilling location of GLL07-01, conducted on October 26, 2007.

Photograph 2. Well completion, GLL07-01.

Photograph 3. Drilling of GLL07-02 near portal entrance, October 26, 2007.

Photograph 4. Well completion, GLL07-02.

Photograph 5. Drilling GLL07-03 in pit bottom, October 25, 2007.



Photograph 6. Well completion, GLL07-03.

Photograph 7. Water sampling and surveying at GLL07-03.

Photograph 8. Surveying Pony Creek to obtain a stream profile.

Photograph 9. Surveying pit lake water elevation and pit water sampling location; adits located in background.

Photograph 10. West adit noted to be dry.

Photograph 11. Frozen water in East adit; note icycle formation.
This site was uncharacteristically ice free compared to previous winter site visits.

Appendix C

Photo Log – Drilling Grab Samples

Photograph 1. GLL07-01 (2'-20')

Photograph 2. GLL07-01 (22'-40')

Photograph 3. GLL07-01 (42'-60')

Photograph 4. GLL07-02 (2'-20')

Photograph 5. GLL07-03 (2'-20')

Photograph 6. GLL07-03 (22'-34')

Appendix D

Analytical Laboratory Report

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

Environmental Division

ANALYTICAL REPORT

GARTNER LEE LTD.

ATTN: JEN FUNSTON

2251 2ND AVENUE

WHITEHORSE YT Y1A 5W1

Reported On: 08-FEB-08 09:26 AM
Revision: 1

Lab Work Order #: **L581752** **Date Received:** **27-NOV-07**

Project P.O. #:
Job Reference: 70803
Legal Site Desc: MT. NANSEN MINE
CofC Numbers: A014930

Other Information:

Comments: Please note that this revision of the report contains lower detection limits for dissolved Chromium, Selenium and Thallium.

Joyce Chow
General Manager, Vancouver

For any questions about this report please contact your Account Manager:

NATASHA MARKOVIC-MIROVIC

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Part of the **ALS Laboratory Group**
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Phone: +1 604 253 4188 Fax: +1 604 253 6700 www.alsglobal.com
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ALS LABORATORY GROUP ANALYTICAL REPORT

		Sample ID	L581752-1	L581752-2			
		Description					
		Sampled Date	23-NOV-07	23-NOV-07			
		Sampled Time					
		Client ID	PIT NORTH END	GLL07-03			
Grouping	**Analyte**						
WATER							
Physical Tests	Hardness (as CaCO3) (mg/L)		802	912			
	Conductivity (uS/cm)		1340	1560			
	pH (pH)		7.97	6.77			
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)		153	73.8			
	Alkalinity, Carbonate (as CaCO3) (mg/L)		<2.0	<2.0			
	Alkalinity, Hydroxide (as CaCO3) (mg/L)		<2.0	<2.0			
	Alkalinity, Total (as CaCO3) (mg/L)		153	73.8			
	Sulfate (SO4) (mg/L)		654	866			
	Nitrate (as N) (mg/L)		0.846	3.72			
Dissolved Metals	Aluminum (Al)-Dissolved (mg/L)		<0.025	0.091			
	Antimony (Sb)-Dissolved (mg/L)		0.0092	<0.0025			
	Arsenic (As)-Dissolved (mg/L)		0.0140	<0.0025			
	Barium (Ba)-Dissolved (mg/L)		<0.020	<0.020			
	Beryllium (Be)-Dissolved (mg/L)		<0.0050	<0.0050			
	Boron (B)-Dissolved (mg/L)		<0.10	<0.10			
	Cadmium (Cd)-Dissolved (mg/L)		0.00220	0.227			
	Calcium (Ca)-Dissolved (mg/L)		220	264			
	Chromium (Cr)-Dissolved (mg/L)		<0.0010	<0.0010			
	Cobalt (Co)-Dissolved (mg/L)		<0.0015	0.0081			
	Copper (Cu)-Dissolved (mg/L)		0.0123	0.127			
	Iron (Fe)-Dissolved (mg/L)		<0.030	7.78			
	Lead (Pb)-Dissolved (mg/L)		<0.0025	<0.0025			
	Lithium (Li)-Dissolved (mg/L)		<0.025	<0.025			
	Magnesium (Mg)-Dissolved (mg/L)		61.6	61.5			
	Manganese (Mn)-Dissolved (mg/L)		0.0627	8.29			
	Mercury (Hg)-Dissolved (mg/L)		<0.000020	<0.000020			
	Molybdenum (Mo)-Dissolved (mg/L)		<0.0050	<0.0050			
	Nickel (Ni)-Dissolved (mg/L)		<0.0050	0.0331			
	Potassium (K)-Dissolved (mg/L)		2.2	2.6			
	Selenium (Se)-Dissolved (mg/L)		<0.0010	<0.0010			
	Silver (Ag)-Dissolved (mg/L)		<0.00010	<0.00010			
	Sodium (Na)-Dissolved (mg/L)		8.3	7.0			
	Thallium (Tl)-Dissolved (mg/L)		<0.00020	<0.00020			
	Tin (Sn)-Dissolved (mg/L)		<0.0025	<0.0025			
	Titanium (Ti)-Dissolved (mg/L)		<0.010	<0.010			
	Uranium (U)-Dissolved (mg/L)		0.0033	<0.0010			
	Vanadium (V)-Dissolved (mg/L)		<0.0050	<0.0050			
	Zinc (Zn)-Dissolved (mg/L)		0.377	15.5			

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Analytical Method Reference(Based On)
ALK-SCR-VA	Water	Alkalinity by colour or titration	EPA 310.2 OR APHA 2320

This analysis is carried out using procedures adapted from EPA Method 310.2 "Alkalinity". Total Alkalinity is determined using the methyl orange colourimetric method.
OR
This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.

ANIONS-NO3-IC-VA	Water	Nitrate by Ion Chromatography	APHA 4110 "Determination of Anions by IC

This analysis is carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Anions routinely determined by this method include: bromide, chloride, fluoride, nitrate, nitrite and sulphate.

ANIONS-SO4-IC-VA	Water	Sulfate by Ion Chromatography	APHA 4110 "Determination of Anions by IC

This analysis is carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Anions routinely determined by this method include: bromide, chloride, fluoride, nitrate, nitrite and sulphate.

EC-PCT-VA	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.

HARDNESS-CALC-VA	Water	Hardness	APHA 2340B

Hardness is calculated from Calcium and Magnesium concentrations, and is expressed as calcium carbonate equivalents.

HG-DIS-CCME-CVAFS-VA	Water	Diss. Mercury in Water by CVAFS (CCME)	EPA 3005A/245.7

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by filtration (EPA Method 3005A) and involves a cold-oxidation of the acidified sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry (EPA Method 245.7).

MET-DIS-CCME-ICP-VA	Water	Diss. Metals in Water by ICPOES (CCME)	EPA SW-846 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

MET-DIS-CCME-MS-VA	Water	Diss. Metals in Water by ICPMS (CCME)	EPA SW-846 3005A/6020A

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).

PH-PCT-VA	Water	pH by Meter (Automated)	APHA 4500-H "pH Value"

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

** Laboratory Methods employed follow in-house procedures, which are generally based on nationally or internationally accepted methodologies.
The last two letters of the above ALS Test Code column indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location	Laboratory Definition Code	Laboratory Location
VA	ALS LABORATORY GROUP - VANCOUVER, BC, CANADA		

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Analytical Method Reference(Based On)

GLOSSARY OF REPORT TERMS
Surr - A surrogate is an organic compound that is similar to the target analyte(s) in chemical composition and behavior but not normally detected in enviromental samples. Prior to sample processing, samples are fortified with one or more surrogate compounds.
The reported surrogate recovery value provides a measure of method efficiency.
mg/kg (units) - unit of concentration based on mass, parts per million
mg/L (units) - unit of concentration based on volume, parts per million
N/A - Result not available. Refer to qualifier code and definition for explanation

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Although test results are generated under strict QA/QC protocols, any unsigned test reports, faxes, or emails are considered preliminary.

ALS Laboratory Group has an extensive QA/QC program where all analytical data reported is analyzed using approved referenced procedures followed by checks and reviews by senior managers and quality assurance personnel. However, since the results are obtained from chemical measurements and thus cannot be guaranteed, ALS Laboratory Group assumes no liability for the use or interpretation of the results.

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

Environmental Division

CHAIN OF CUSTODY / ANALYTICAL REQUEST FORM

COC # A014930

CANADA TOLL FREE 1-800-668-9878

www.alsenviro.com

Page 1 of 1

REPORT TO: Natasha Markovic Miravic	REPORT FORMAT / DISTRIBUTION	SERVICE REQUESTED
COMPANY: Gartner Lee Limited	STANDARD ✓ OTHER	✓ REGULAR SERVICE (DEFAULT)
CONTACT: Jen Funston	PDF ✓ EXCEL ✓ CUSTOM FAX	RUSH SERVICE (2-3 DAYS)
ADDRESS: 2251 2nd Avenue	EMAIL 1: jfunston@gartnerlee.com	PRIORITY SERVICE (1 DAY or ASAP)
Whitehorse Yukon Y1A 5W1	EMAIL 2:	EMERGENCY SERVICE (<1 DAY / WEEKEND) - CONTACT ALS
PHONE: 867.633.6474 FAX: 867.633.6321		ANALYSIS REQUEST
INVOICE TO: SAME AS REPORT ? (YES) / NO	INDICATE BOTTLES: FILTERED / PRESERVED (F/P) → → →	
COMPANY:	CLIENT / PROJECT INFORMATION:	
CONTACT:	JOB #: 70803	
ADDRESS:	PO /AFE:	
	Legal Site Description: Mt. Nansen Mine	
PHONE: FAX:	QUOTE #:	
Lab Work Order # (lab use only): LS81752		SAMPLER (Initials): JK, JF

Sample #	SAMPLE IDENTIFICATION (This description will appear on the report)	DATE	TIME	SAMPLE TYPE	General Chemistry	pH, hardness, cond.,	alkalinity (total), bicarbonate, carbonate, hydroxide	phenol, thiocyanate, sulphide, nitrate, nitrite	Dissolved Metals	HAZARDOUS ?	HIGHLY CONTAMINATED ?	NUMBER OF CONTAINERS
	Pit North End	Nov. 23, 2007		SW	X				X			
	GLL07-03	Nov. 23, 2007		GW	X				X			

GUIDELINES / REGULATIONS	SPECIAL INSTRUCTIONS / HAZARDOUS DETAILS

Failure to complete all portions of this form may delay analysis. Please fill in this form *LEGIBLY*.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the reverse page of the white report copy.

RELINQUISHED BY:	DATE & TIME:	RECEIVED BY:	DATE & TIME:	SAMPLE CONDITION (lab use only)	
Jen Funston	Nov. 23/07 9am	HD 071127	3:03	TEMPERATURE 4 °C	SAMPLES RECEIVED IN GOOD CONDITION (YES) NO (If no provide details)
RELINQUISHED BY:	DATE & TIME:	RECEIVED BY:	DATE & TIME:		

REFER TO BACK PAGE FOR REGIONAL LOCATIONS AND SAMPLING INFORMATION

WHITE - REPORT COPY, PINK - FILE COPY, YELLOW - CLIENT COPY

GENF14.00

Appendix E

Aquifer Test Analysis Results

Gartner Lee Limited
2251 2nd Avenue
Whitehorse, Yukon, Y1A 5W1
Phone 867.633.6474

Pumping Test Data Report

Project: Mt. Nansen Hydrogeo 2008

No: 70803

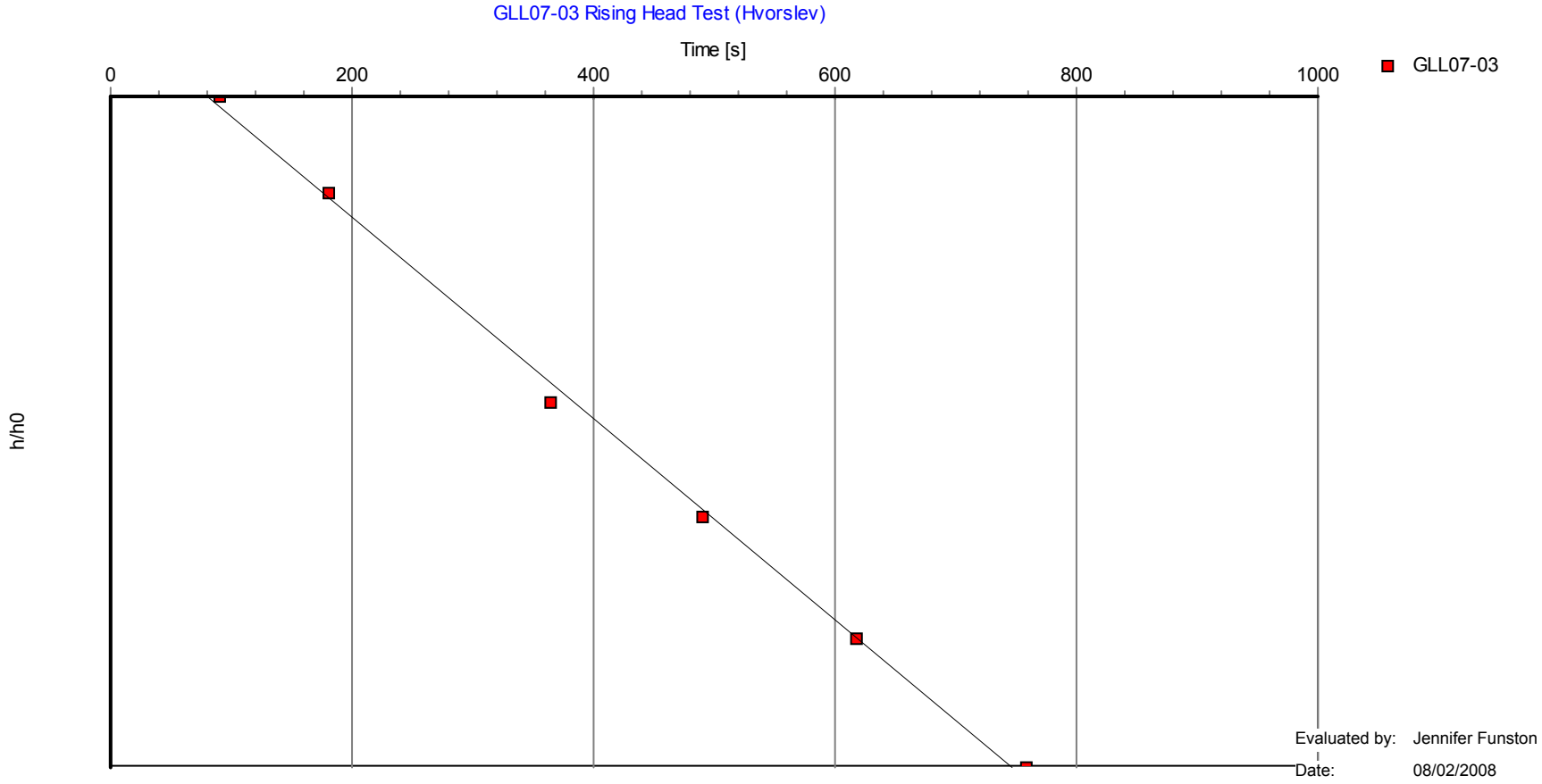
Client: Energy Mines and Resources, GY

Data observed at:	**GLL07-03**	**Slug test:**	**GLL07-03 Rising Head Test**
Distance from PW:	0 [m]	Test well:	GLL07-03
Depth to static WL:	5.87 [m]	Screen radius:	0.0762 [m]
Location:	Mt. Nansen Mine Site	Screen length:	1.8288 [m]
Test performed by:	Jennifer Funston	Casing radius:	0.0762 [m]
Date:	08/02/2008	Aquifer thickness:	2 [m]

	Time [s]	Depth to WL [m]	Drawdown [m]
1	0	8.00	2.13
2	90	7.90	2.03
3	180	7.80	1.93
4	365	7.60	1.73
5	490	7.50	1.63
6	618	7.40	1.53
7	758	7.30	1.43

Gartner Lee Limited
2251 2nd Avenue
Whitehorse, Yukon, Y1A 5W1
Phone 867.633.6474

Pumping Test Analysis Report	**Slug test: GLL07-03 Rising Head Test**
Project: Mt. Nansen Hydrogeo 2008	**Analysis method: Hvorslev**
No: 70803	Comments:
Client: Energy Mines and Resources,	



Analysis results:

Conductivity: 2.67E-6 [m/s]

Test parameters:

Test well:	GLL07-03		
Screen radius:	0.0762 [m]	Aquifer thickness:	2 [m]
Screen length:	1.8288		
Casing radius:	0.0762 [m]		