



APPENDIX F

Bioaccessibility Analysis Report, Golder Associates, Canada



October 2012

REPORT ON

Bioaccessibility Testing of Impacted Soil at a Community in New Zealand

Submitted to:
Mr. David Bull
Golder Associates (NZ) Ltd.
Takapuna, NZ

REPORT



Report Number: 12-1152-0166

1 e-copy - Golder Associates (NZ) Ltd.
2 copies – Golder Associates Ltd.





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APPENDIX A

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1.0 INTRODUCTION

Golder Associates Ltd. (Golder) conducted *in vitro* bioaccessibility testing of metals-contaminated soil samples collected from a community in New Zealand (“Site”). The objective of the bioaccessibility testing was to provide more realistic estimates of the amount of metals that are readily absorbed following incidental ingestion of contaminated soils. The results of the bioaccessibility testing of arsenic and lead in Site soils will be applied in support of the Human Health Risk Assessment (HHRA) being conducted for the Site.

This report outlines the rationale, methods and results of the bioaccessibility testing. An interpretation of the results of the testing and the recommended use of the data in the HHRA are also provided.

2.0 RATIONALE FOR BIOACCESSIBILITY TESTING

Soil ingestion is a major exposure pathway for humans potentially exposed to metals-contaminated soils. In children, soil ingestion is thought to occur primarily through hand-to-mouth behaviour (i.e., soil adheres to hands or toys, which are then put, intentionally or incidentally, in the mouth). Although there is some controversy regarding the most relevant soil size fraction that adheres to hands, the <250 µm fraction is thought to be the most likely size fraction ingested during hand-to-mouth behaviour.

Subsequent to soil ingestion, metals can be released from the soil and absorbed during the digestive process. The fraction of the ingested metal released from the soil and into the gastrointestinal tract is defined as the *bioaccessible* fraction of the metal, while the *bioavailable* fraction of the ingested metal is the fraction that is absorbed from the gastrointestinal tract and into the blood compartment. To become bioavailable, soil-bound metals must first become bioaccessible, and not necessarily all of the metal that becomes bioaccessible is bioavailable.

Typically, metal bioavailability is lower in soil than it is in food and liquids; however, these media are typically used in the toxicity studies upon which toxicity reference values (TRVs) used in HHRA are based. In HHRA, media effects on metal bioavailability can be accounted for through the use of a relative bioavailability adjustment (RBA), also known as a relative absorption factor (RAF). When the TRV represents an applied dose, the RAF is the ratio of the bioavailability of the metal in soil relative to the bioavailability of the metal in the medium used in the toxicity study upon which the TRV is based. When the TRV represents an absorbed dose, the RAF is simply the bioavailability of the chemical in soil.

$$\text{RAF}_{(\text{exposure route})} = \frac{\text{Bioavailability of chemical in site-specific exposure medium}}{\text{Bioavailability of chemical in toxicity study}}$$

Nonetheless, HHRAs often use an assumed value of 1 for the RBA or RAF for the ingestion of soil-bound metals to remain conservative. This is because metal bioavailability varies with soil samples and it would be very expensive, time-consuming and unethical to assess the bioavailability of each soil sample with animal (*in vivo*) studies. As such, human health risks for ingestion of metal-contaminated soils may often be overestimated. For these reasons, *in vitro* methods have been developed with the objective of simulating the human gastrointestinal environment, and estimating the bioaccessibility of soil-bound metals. This approach is thought to be a



reasonable surrogate for the bioavailability of soil-bound metals, on a site-specific basis (Ellickson *et al.*, 2001; Hamel *et al.*, 1998; Rodriguez *et al.*, 1999; Ruby *et al.*, 1993; Ruby *et al.*, 1996; Schroder *et al.*, 2003; Schroder *et al.*, 2004). For a small set of metals (i.e., lead, arsenic, cadmium), estimates from these *in vitro* bioaccessibility tests have correlated well with *in vivo* estimates of relative bioavailability using several animal models (Rodriguez *et al.*, 1999; Ruby *et al.*, 1996; Ruby *et al.*, 1999; Schroder *et al.*, 2003; Schroder *et al.*, 2004). Use of these validated *in vitro* tests in HHRAs can provide more accurate risk estimates for ingestion of metals-contaminated soils by providing more accurate RAFs without the need for animal testing.

2.1 *In Vitro* Bioaccessibility Test

Of the available *in vitro* bioaccessibility tests, Golder chose to adopt and implement the test developed in the laboratory of Dr. John Drexler (University of Colorado at Boulder), the Relative Bioavailability Leach Procedure (RBALP), for the bioaccessibility testing in support of the HHRA for the Site (the standard operating procedure for the RBALP is available at <http://www.colorado.edu/geolsci/legs/invitro1.html>). The RBALP was chosen for five reasons:

- 1) A correlation has been demonstrated between *in vivo* measures of lead bioavailability in the swine, the animal model of choice for its similarities to humans in terms of gastrointestinal physiology, and *in vitro* measures of lead bioaccessibility using the RBALP;
- 2) The procedure has undergone both intra- and inter-laboratory validation in three independent laboratories;
- 3) The RBALP includes an extensive quality assurance and quality control (QA/QC) protocol;
- 4) Sensitivity analysis of the procedure has been performed with respect to soil/liquid ratios, pH, temperature, gastric solution composition, extraction time and post-extraction stability; and,
- 5) The RBALP has been used in several regulatory agency-endorsed HHRAs, including HHRAs endorsed by the U.S. Environmental Protection Agency (U.S. EPA) and state agencies (e.g., California EPA). In addition, a procedure very similar to the RBALP has been used by the Ontario Ministry of the Environment in a HHRA involving metals-contaminated soils (MOE, 2002).

The RBALP is an extraction procedure that simulates the acidic human stomach environment and is conducted as follows: one gram of soil (<250 µm soil fraction) is added to 100 mL of extraction fluid (a 0.4 M glycine solution adjusted to pH 1.5 using hydrochloric acid). The solution is rotated end-over-end at 37°C for 1 h, following which the supernatant is extracted, filtered, acidified and analyzed for lead. QA/QC samples, including bottle blanks, and Standard Reference Materials (SRM; from the National Institute of Standards and Technology (NIST)), are also analyzed for arsenic or lead.

3.0 METHODS FOR BIOACCESSIBILITY TESTING

3.1 Soil Samples

The bioaccessibility testing used ten soil samples that had previously been dried and sieved to the <250 µm size fraction. The preparation of soil samples is consistent with the original RBALP. For each sample, a subsample



of the <250 µm fraction was submitted to AGAT Laboratories (Mississauga, ON). There, soil fractions were digested and analyzed for ICP-MS metals using EPA method 3050B (U.S. EPA, 1996).

3.2 Gastric Extraction of Soil Samples

3.2.1 Preparation of Gastric Extraction Fluid

Gastric extraction fluid was prepared by adding 60.06 g of glycine to 1.9 L of de-ionized water. The solution was heated to a temperature of 37°C in a water bath and then concentrated (trace metal grade) hydrochloric acid was added until the solution reached a pH of 1.5 ± 0.05 . The solution was then topped up to a final volume of 2 L with de-ionized water, yielding a 0.4 M glycine solution. During preparation of the extraction fluid, the solution was constantly stirred on a stir plate. Prior to use of the extraction fluid in the test, the pH was checked and adjusted if necessary to pH 1.5 ± 0.05 with hydrochloric acid.

3.2.2 Gastric Extraction Technique

The gastric extraction was conducted as follows: for each sample, one gram of the <250 µm size soil fraction was placed in a wide-mouth HPDE bottle. One hundred millilitres of gastric extraction fluid, heated to 37°C, was then added to the bottles. The bottles were then sealed and placed in a modified TCLP extractor at 37°C for 1 h at a shaking setting of 30 rpm.

After the 1 hour extraction period, the bottles were removed from the extractor. Ten millilitres of extraction fluid was removed from each bag and filtered through a 0.45 µm filter. The samples were submitted to AGAT Laboratories (Mississauga, ON) the same day, where they were analyzed by ICP-MS using EPA method 6020A (U.S. EPA, 2007). The pH of the remaining fluid in the bottles was measured to ensure the pH was within 0.5 pH units of the starting pH. The modified TCLP extractor could only hold 10 samples at one time. Therefore, two rounds of extractions were run including a separate bottle blank in each round.

3.3 Quality Assurance and Quality Control (QA/QC)

The following additional samples were submitted to AGAT Laboratories (Mississauga, ON) for a total metals scan in order to assure the generation of high-quality bioaccessibility data:

- Bottle blank: extraction fluid subjected to the extraction procedure. Two bottle blanks were submitted, one for each round of gastric extraction;
- Water blank: deionized water used in the preparation of the extraction fluid; and
- Standard Reference Materials (SRM): bulk analysis and analysis of an extract of the NIST SRM 2711 and NIST SRM 2711a (Montana II Soil).



3.4 Calculation of Bioaccessibility

The bioaccessibility of each metal was calculated as a percent of the mass-balance quotient of the metal mass in the gastric extraction fluid and the metal mass in the <250 µm soil fraction, as follows:

$$Bioaccessibility (\%) = \frac{mass\ metal\ in\ extract}{mass\ metal\ in\ soil} \times 100\% = \frac{[metal]_{extract} \times volume\ of\ extract}{[metal]_{soil} \times mass\ of\ soil} \times 100\% \quad (1)$$

4.0 RESULTS

4.1 Bioaccessibility Results for Arsenic

As shown in Table 3 below, the bioaccessibility estimates ranged from 0.2 to 36.3 %. The average arsenic bioaccessibility was 11.5 % and the standard deviation was 13.3%. There are too few data points to perform meaningful statistics on the data.

As discussed further in the QA/QC section below, the blanks contained 0.0052 mg/L and 0.0107 mg/L of arsenic. The concentrations in the gastric fluid were adjusted for the arsenic detected in the blank. Sample Ensor 409/400-500 had a concentration in gastric fluid below the method detection limit, therefore this sample was not corrected for the blank.

Table 1: Bioaccessibility Results for Arsenic

Soil Sample ID	Concentration in <250 µm Soil (mg/kg)	Concentration in Gastric Fluid (mg/L)	Mass of Soil (g)	Volume of Gastric Fluid (L)	Bioaccessibility (%)
Ensor 409/0-100	26	0.006	1.0300	0.1	2.2
Ensor 409/400-500	49	<0.001*	1.0421	0.1	0.2
Fergusson 103/0-100	95	0.0367	1.0046	0.1	3.8
Fergusson 103/400-500	915	0.2058	1.0230	0.1	2.2
Kuranui 209/0-100	101	0.1303	1.0427	0.1	12.4
Kuranui 209/400-500	288	0.1083	1.0219	0.1	3.7
Moanataiari 207/0-100	51	0.1248	1.0363	0.1	23.6
Moanataiari 207/400-500	158	0.0275	1.0075	0.1	1.7
Queen 1101/0-100	364	1.0893	1.0324	0.1	29.0
Queen 1101/400-500	171	0.6448	1.0379	0.1	36.3



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Soil Sample ID	Concentration in <250 µm Soil (mg/kg)	Concentration in Gastric Fluid (mg/L)	Mass of Soil (g)	Volume of Gastric Fluid (L)	Bioaccessibility (%)
Number of Samples					10
Average					11.5 %
Standard Deviation					13.3 %
Minimum					0.2 %
Maximum					36.3 %

* Sample was not corrected for the bottle blank as measured concentration in the sample was below the method detection limit.

4.2 Bioaccessibility Results for Lead

As shown in Table 4 below, the bioaccessibility estimates ranged from 3.2 to 47.7 %. The average lead bioaccessibility was 34.8 % and the standard deviation was 14.2 %. There are too few data points to perform meaningful statistics on the data. As discussed further in the QA/QC section below, the blanks contained 0.0662 mg/L and 0.0091 mg/L of lead. The concentrations in the gastric fluid were adjusted for the lead detected in the blank. Sample Ensor 409/400-500 had a concentration in gastric fluid below the concentration detected in the blank, therefore this sample was not corrected for the blank.

Table 2: Bioaccessibility Results for Lead

Soil Sample ID	Concentration in <250 µm Soil (mg/kg)	Concentration in Gastric Fluid (mg/L)	Mass of Soil (g)	Volume of Gastric Fluid (L)	Bioaccessibility (%)
Ensor 409/0-100	45	0.1919	1.0300	0.1	41.4
Ensor 409/400-500	12	0.0463*	1.0421	0.1	37
Fergusson 103/0-100	119	0.3588	1.0046	0.1	30
Fergusson 103/400-500	326	0.1058	1.0230	0.1	3.2
Kuranui 209/0-100	797	3.9609	1.0427	0.1	47.7
Kuranui 209/400-500	322	1.2809	1.0219	0.1	38.9
Moanataiari 207/0-100	66	0.3098	1.0363	0.1	45.3
Moanataiari 207/400-500	44	0.0798	1.0075	0.1	18
Queen 1101/0-100	518	2.5109	1.0324	0.1	47
Queen	214	0.8788	1.0379	0.1	39.6



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Soil Sample ID	Concentration in <250 µm Soil (mg/kg)	Concentration in Gastric Fluid (mg/L)	Mass of Soil (g)	Volume of Gastric Fluid (L)	Bioaccessibility (%)
1101/400-500					
Number of Samples					10
Average					34.8 %
Standard Deviation					14.2 %
Minimum					3.2 %
Maximum					47.7 %

* Sample was not corrected for the bottle blank as measured concentration in the sample was below the concentration measured in the blank.

4.3 Quality Assurance and Quality Control (QA/QC)

Quality assurance and quality control for the RBALP method is ensured through analysis of arsenic and lead as described below.

The concentrations of arsenic in the bottle blanks of 0.0052 mg/L and 0.0107 mg/L were lower than the established control limit of <0.050 mg/L. The concentration of lead in the bottle blank was above the established control limit of < 0.050 mg/L in round 1 (0.0662 mg/L) and below the established control limit in round 2 (0.0091 mg/L). Given this, the metal mass in the extraction fluid was corrected for the metal mass in the bottle blank in the bioaccessibility calculations. An exception was for sample Ensor 409/400-500 which had an arsenic concentration in gastric fluid below the method detection limit and a lead concentration below the concentration detected in the blank. In both cases this sample was not corrected for the blank.

The concentrations of arsenic and lead in the de-ionized water blank of 0.001 mg/L and 0.0006 mg/L were negligible.

Relative percent differences (RPDs) in arsenic and lead bioaccessibility were calculated for a duplicate soil sample and a duplicate extraction fluid. The RPDs in soil were 8.2 % and 5.6 %, respectively, meeting the established control limit of $\pm 20\%$. The RPDs in extraction fluid were 55.65 % and 82.55 %, respectively, which is above the established control limit of $\pm 20\%$.

Analysis of 18 blind splits of SRM 2711 that had undergone the RBALP extraction in four independent laboratories resulted in lead concentrations of 9.22 ± 1.50 mg/L lead (MOE, 2002). Using the standard RBALP, the concentration of lead in the SRM 2711 that had undergone the extraction in the Golder laboratory was 9.07 mg/L (878.7 mg/kg), which is within this range. In comparison, extraction fluid from SRM 2711a had a lead concentration of 10.8 mg/L (1043.6 mg/kg), which is above the range for SRM 2711. Extraction fluid from SRM 2711 and SRM 2711a had arsenic concentrations of 0.523 mg/L (50.6 mg/kg) and 0.540 mg/L (52.5 mg/kg), respectively.

The results of the QA/QC program are summarized in Table 5 below. As shown in this table, all QA/QC samples were within the established control limits.



Table 3: Control Limits and Results of the Quality Assurance and Quality Control Program

QA/QC Sample	Control Limit	Result (Arsenic)	Result (Lead)
Bottle Blanks	<0.050 mg/L	0.0052 mg/L and 0.0107 mg/L	0.0662 mg/L and 0.0091 mg/L
De-ionized Water Blank	-	0.001 mg/L	0.0006 mg/L
Duplicate (soil)	±20% RPD	8.2 %	5.6 %
Duplicate (extraction fluid)	±20% RPD	55.65 %	82.55 %
SRM 2711 (soil)	-	93 mg/kg	1050 mg/kg
SRM 2711 (extraction fluid)	9.22±1.5 mg/L (lead)	0.523 mg/L (50.6 mg/kg)	9.07 mg/L (878.7 mg/kg)
SRM 2711a (soil)	-	106 mg/kg	1340 mg/kg
SRM 2711a (extraction fluid)	9.22±1.5 mg/L (lead)	0.540 mg/L (52.5 mg/kg)	10.8 mg/L (1043.6 mg/kg)

5.0 REFERENCES

- Ellickson, K.M., Meeker, R.J., Gallo, M.A., Buckley, B.T., and Lioy, P.J. (2001) Oral Bioavailability of Lead and Arsenic from a NIST Standard Reference Soil Material. *Archives of Environmental Contamination and Toxicology* **40**: 128-135.
- Hamel, S.C., Buckley, B., and Lioy, P.J. (1998) Bioaccessibility of metals in soils for different liquid to solid ratios in synthetic gastric fluid. *Environmental Science & Technology* **32**: 358-362.
- MOE (Ontario Ministry of Environment) (2002). Soil Investigation and Human Health Risk Assessment for the Rodeny Street Community, Port Colbourne.
- Ontario Ministry of Environment and Energy (1996). Rationale for the Development and Application of Generic Soil, Groundwater and Sediment Criteria for use at Contaminated Sites in Ontario.
- Rodriguez, R.R., Basta, N.T., Casteel, S.W., and Pace, L.W. (1999) An *In Vitro* Gastrointestinal Method to Estimate Bioavailable Arsenic in Contaminated Soils and Solid Media. *Environmental Science & Technology* **33**: 642-649.
- Ruby, M.V., Davis, A., Link, T.E., Schoof, R., Chaney, R.L., Freeman, G.B., and Bergstrom, P.D. (1993) Development of an *In Vitro* Screening Test to Evaluate the *In Vivo* Bioaccessibility of Ingested Mine-Waste Lead. *Environmental Science & Technology* **27**: 2870-2877.
- Ruby, M.V., Davis, A., Schoof, R., Eberle, S., and Sellstone, C.M. (1996) Estimation of lead and arsenic bioavailability using a physiologically based extraction test. *Environmental Science & Technology* **30**: 422-430.



Ruby, M.V., Schoof, R., Brattin, W., Goldade, M., Post, G., Harnois, M. *et al.* (1999) Advances in Evaluating the Oral Bioavailability of Inorganics in Soil for Use in Human Health Risk Assessment. *Environmental Science & Technology* **33**: 3697-3705.

Schroder, J.L., Basta, N.T., Casteel, S.W., Evans, T.J., Payton, M.E., and Si, J. (2004) Validation of the In Vitro Gastrointestinal (IVG) method to Estimate Relative Bioavailable Lead in Contaminated Soils. *Journal of Environmental Quality* **33**: 513-521.

Schroder, J.L., Basta, N.T., Si, J., Casteel, S.W., Evans, T., and Payton, M.E. (2003) In Vitro Gastrointestinal Method to Estimate Relative Bioavailable Cadmium in Contaminated Soil. *Environmental Science & Technology* **37**: 1365-1370.

U.S. Environmental Protection Agency (1980). Test Methods for Evaluating Solid Waste, Physical/Chemical Methods. Method 3050B Acid Digestion of Sediments, Sludges and Soils. SW-846. Revision 2, December 1996. U.S. Environmental Protection Agency. Washington, DC. Available from <http://www.epa.gov/epawaste/hazard/testmethods/sw846/pdfs/3050b.pdf>.

U.S. Environmental Protection Agency (2007). Test Methods for Evaluating Solid Waste, Physical/Chemical Methods. Method 6020a Inductively Coupled Plasma-Mass Spectrometry. SW-846. Revision 1, February 2007. U.S. Environmental Protection Agency. Washington, DC. Available from <http://www.epa.gov/epawaste/hazard/testmethods/sw846/pdfs/6020a.pdf>.

6.0 CLOSURE

We trust that this report meets your current requirements. If you have any questions or are in need of additional information, please contact the undersigned.



Report Signature Page

GOLDER ASSOCIATES LTD.

Handwritten signature of Sharon Guin in blue ink.

Sharon Guin, M.Sc
Junior Environmental Risk Assessor

Handwritten signature of Theresa Repaso-Subang in blue ink.

Theresa Repaso-Subang, B.Sc., DABT
Team Leader - Toxicology & Risk Assessment

SG/TRS/rh/cg

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APPENDIX A

Certificates of Analysis and Chain of Custody



CLIENT NAME: GOLDER ASSOCIATES LTD.
2390 ARGENTIA ROAD
MISSISSAUGA, ON L5N5Z7
(905) 567-6100

ATTENTION TO: Andrea Amendola

PROJECT NO: 12-1152-0166

AGAT WORK ORDER: 12T645174

SOIL ANALYSIS REVIEWED BY: Robert Hamel, PhD (Chem), General Manager

WATER ANALYSIS REVIEWED BY: Anthony Dapaah, PhD (Chem), Inorganic Lab Manager

DATE REPORTED: Oct 01, 2012

PAGES (INCLUDING COVER): 14

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.



AGAT Laboratories

Certificate of Analysis

AGAT WORK ORDER: 12T645174

PROJECT NO: 12-1152-0166

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
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CLIENT NAME: GOLDER ASSOCIATES LTD.

ATTENTION TO: Andrea Amendola

DATE SAMPLED: Sep 24, 2012	DATE RECEIVED: Sep 24, 2012	DATE REPORTED: Oct 01, 2012	SAMPLE TYPE: Soil								
O. Reg. 153(511) - Metals (Comprehensive) (Soil)											
Parameter	Unit	G/S	RDL	Montana 2711 3741061	Montana 2711A 3741072	EN 409/400-500 3741073	1101-400-500 3741074	MO 207/0-100 3741075	MO 207/400-500 3741076	FE 103/400-500 3741077	FE 103/0-100 3741078
Antimony	µg/g	1	0.8	10.9	14.2	4.1	7.0	1.8	4.9	38.9	5.6
Arsenic	µg/g	11	1	93	106	49	171	51	158	915	95
Boron	µg/g	36	5	8	9	<5	265	8	7	<5	<5
Barium	µg/g	210	2	193	214	94	284	141	79	329	153
Beryllium	µg/g	2.5	0.5	1.0	1.1	0.6	1.8	0.5	0.6	<0.5	<0.5
Cadmium	µg/g	1	0.5	36.7	50.7	<0.5	<0.5	<0.5	<0.5	<0.5	0.6
Chromium	µg/g	67	2	20	23	13	19	26	15	9	19
Cobalt	µg/g	19	0.5	7.7	8.1	14.4	7.4	10.6	17.0	5.8	10.0
Copper	µg/g	62	1	95	124	58	104	51	51	68	56
Lead	µg/g	45	1	1050	1340	12	214	66	44	326	119
Molybdenum	µg/g	2	0.5	1.2	1.4	0.6	2.4	1.0	3.1	6.9	1.6
Nickel	µg/g	37	1	15	18	5	11	9	15	4	8
Selenium	µg/g	1.2	0.4	1.6	1.7	1.3	1.2	1.1	1.4	2.4	0.9
Silver	µg/g	0.5	0.2	4.0	6.1	<0.2	0.6	<0.2	0.5	10.9	0.7
Thallium	µg/g	1	0.4	1.6	2.1	0.6	0.4	0.4	0.9	8.6	1.0
Uranium	µg/g	1.9	0.5	0.9	0.9	<0.5	0.9	0.5	<0.5	<0.5	<0.5
Vanadium	µg/g	86	1	41	43	82	24	54	47	39	55
Zinc	µg/g	290	5	322	411	57	137	203	120	177	195

Certified By:



AGAT Laboratories

Certificate of Analysis

AGAT WORK ORDER: 12T645174

PROJECT NO: 12-1152-0166

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CLIENT NAME: GOLDER ASSOCIATES LTD.

ATTENTION TO: Andrea Amendola

DATE SAMPLED: Sep 24, 2012	DATE RECEIVED: Sep 24, 2012	DATE REPORTED: Oct 01, 2012	SAMPLE TYPE: Water								
O. Reg. 153(511) - Metals (Comprehensive) (Water)											
Parameter	Unit	G/S	RDL	Montana 2711 3741046	Montana 2711A 3741047	EN 409/400-500 3741048	1101-400-500 3741049	MO 207/0-100 3741050	MO 207/400-500 3741051	FE 103/400-500 3741052	FE 103/0-100 3741053
Antimony	µg/L	1.5	0.5	15.6	17.7	1.2	3.4	1.2	1.1	8.3	1.8
Arsenic	µg/L	13	1.0	528	545	<1.0	650	130	32.7	211	41.9
Barium	µg/L	610	2.0	1290	1260	442	1350	954	306	864	825
Beryllium	µg/L	0.5	0.5	4.4	4.8	0.6	9.8	2.8	3.4	0.7	1.6
Boron	µg/L	1700	10.0	58.9	51.7	21.1	717	87.1	36.0	21.2	27.3
Cadmium	µg/L	0.5	0.2	365	459	1.8	3.9	4.8	3.5	5.0	6.0
Chromium	µg/L	11	2.0	49.0	45.2	37.1	65.3	49.4	42.5	42.2	43.8
Cobalt	µg/L	3.8	0.5	39.0	27.1	35.3	32.6	51.3	51.2	8.4	16.4
Copper	µg/L	5	1.0	469	614	108	414	185	123	222	239
Lead	µg/L	1.9	0.5	9140	10800	46.3	945	376	146	172	425
Molybdenum	µg/L	23	0.5	3.2	2.7	2.3	3.8	1.7	2.3	2.5	2.8
Nickel	µg/L	14	1.0	61.4	52.8	6.5	31.8	28.7	40.7	18.3	44.5
Selenium	µg/L	5	1.0	3.8	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Silver	µg/L	0.3	0.2	23.9	36.8	1.6	1.9	1.5	3.7	41.6	3.5
Thallium	µg/L	0.5	0.3	3.2	3.8	0.9	1.0	1.0	0.9	1.5	<0.3
Uranium	µg/L	8.9	0.5	1.9	2.1	0.7	1.3	1.1	1.0	0.6	1.2
Vanadium	µg/L	3.9	0.4	36.1	35.4	29.7	32.9	70.2	43.0	30.0	32.8
Zinc	µg/L	160	5.0	1050	1350	105	804	1090	312	439	923

Certified By:



AGAT Laboratories

Certificate of Analysis

AGAT WORK ORDER: 12T645174

PROJECT NO: 12-1152-0166

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
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http://www.agatlabs.com

CLIENT NAME: GOLDER ASSOCIATES LTD.

ATTENTION TO: Andrea Amendola

O. Reg. 153(511) - Metals (Comprehensive) (Water)

DATE SAMPLED: Sep 24, 2012

DATE RECEIVED: Sep 24, 2012

DATE REPORTED: Oct 01, 2012

SAMPLE TYPE: Water

Parameter	Unit	G / S	RDL	Blank1	Blank2	EN 409/0-100	Qu 1101/0-100	Ku 209/400-500	Dup Qu	DI water	Ku 209/0-100
				3741054	3741055	3741056	3741057	3741058	1101/0-100	3741059	3741060
Antimony	µg/L	1.5	0.5	<0.5	<0.5	1.0	5.8	5.7	5.4	<0.5	4.4
Arsenic	µg/L	13	1.0	5.2	10.7	16.7	1100	119	1140	1.0	141
Barium	µg/L	610	2.0	<2.0	<2.0	627	1700	566	1740	<2.0	1780
Beryllium	µg/L	0.5	0.5	<0.5	<0.5	2.6	2.8	1.6	2.7	<0.5	3.4
Boron	µg/L	1700	10.0	25.9	20.6	26.8	76.2	22.3	78.9	16.3	40.0
Cadmium	µg/L	0.5	0.2	2.4	<0.2	2.2	9.6	2.8	10.4	<0.2	11.2
Chromium	µg/L	11	2.0	18.7	25.6	45.8	95.8	49.2	97.1	<2.0	79.1
Cobalt	µg/L	3.8	0.5	<0.5	0.8	22.8	38.7	7.5	40.9	<0.5	23.5
Copper	µg/L	5	1.0	41.4	88.7	165	631	209	647	123	599
Lead	µg/L	1.9	0.5	66.2	9.1	201	2520	1290	2490	0.6	3970
Molybdenum	µg/L	23	0.5	3.8	3.1	2.0	1.4	2.2	2.0	1.9	2.1
Nickel	µg/L	14	1.0	5.5	73.5	24.5	46.3	26.3	65.2	6.7	69.5
Selenium	µg/L	5	1.0	<1.0	<1.0	<1.0	2.8	<1.0	<1.0	<1.0	<1.0
Silver	µg/L	0.3	0.2	0.3	<0.2	1.1	5.5	2.4	5.5	<0.2	3.1
Thallium	µg/L	0.5	0.3	<0.3	<0.3	0.4	2.1	0.5	2.3	<0.3	0.6
Uranium	µg/L	8.9	0.5	<0.5	<0.5	3.1	1.3	3.8	1.1	<0.5	6.1
Vanadium	µg/L	3.9	0.4	7.4	10.1	45.7	61.7	42.5	65.5	7.4	44.2
Zinc	µg/L	160	5.0	21.0	39.6	409	4240	687	4370	43.1	2230

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard; Refers to T1(ALL GW) - Current

Certified By:



AGAT Laboratories

Guideline Violation

AGAT WORK ORDER: 12T645174

PROJECT NO: 12-1152-0166

5835 COOPERS AVENUE
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CLIENT NAME: GOLDER ASSOCIATES LTD.

ATTENTION TO: Andrea Amendola

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	GUIDEVALUE	RESULT
3741046	Montana 2711	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Antimony	1.5	15.6
3741046	Montana 2711	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Arsenic	13	528
3741046	Montana 2711	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Barium	610	1290
3741046	Montana 2711	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Beryllium	0.5	4.4
3741046	Montana 2711	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Cadmium	0.5	365
3741046	Montana 2711	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Chromium	11	49.0
3741046	Montana 2711	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Cobalt	3.8	39.0
3741046	Montana 2711	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Copper	5	469
3741046	Montana 2711	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Lead	1.9	9140
3741046	Montana 2711	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Nickel	14	61.4
3741046	Montana 2711	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Silver	0.3	23.9
3741046	Montana 2711	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Thallium	0.5	3.2
3741046	Montana 2711	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Vanadium	3.9	36.1
3741046	Montana 2711	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Zinc	160	1050
3741047	Montana 2711A	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Antimony	1.5	17.7
3741047	Montana 2711A	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Arsenic	13	545
3741047	Montana 2711A	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Barium	610	1260
3741047	Montana 2711A	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Beryllium	0.5	4.8
3741047	Montana 2711A	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Cadmium	0.5	459
3741047	Montana 2711A	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Chromium	11	45.2
3741047	Montana 2711A	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Cobalt	3.8	27.1
3741047	Montana 2711A	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Copper	5	614
3741047	Montana 2711A	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Lead	1.9	10800
3741047	Montana 2711A	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Nickel	14	52.8
3741047	Montana 2711A	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Silver	0.3	36.8
3741047	Montana 2711A	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Thallium	0.5	3.8
3741047	Montana 2711A	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Vanadium	3.9	35.4
3741047	Montana 2711A	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Zinc	160	1350
3741048	EN 409/400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Beryllium	0.5	0.6
3741048	EN 409/400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Cadmium	0.5	1.8
3741048	EN 409/400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Chromium	11	37.1
3741048	EN 409/400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Cobalt	3.8	35.3
3741048	EN 409/400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Copper	5	108
3741048	EN 409/400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Lead	1.9	46.3
3741048	EN 409/400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Silver	0.3	1.6
3741048	EN 409/400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Thallium	0.5	0.9
3741048	EN 409/400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Vanadium	3.9	29.7
3741049	Qu 1101-400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Antimony	1.5	3.4
3741049	Qu 1101-400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Arsenic	13	650
3741049	Qu 1101-400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Barium	610	1350
3741049	Qu 1101-400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Beryllium	0.5	9.8
3741049	Qu 1101-400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Cadmium	0.5	3.9
3741049	Qu 1101-400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Chromium	11	65.3



CLIENT NAME: GOLDER ASSOCIATES LTD.

ATTENTION TO: Andrea Amendola

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	GUIDEVALUE	RESULT
3741049	Qu 1101-400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Cobalt	3.8	32.6
3741049	Qu 1101-400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Copper	5	414
3741049	Qu 1101-400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Lead	1.9	945
3741049	Qu 1101-400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Nickel	14	31.8
3741049	Qu 1101-400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Silver	0.3	1.9
3741049	Qu 1101-400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Thallium	0.5	1.0
3741049	Qu 1101-400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Vanadium	3.9	32.9
3741050	Qu 1101-400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Zinc	160	804
3741050	MO 207/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Arsenic	13	130
3741050	MO 207/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Barium	610	954
3741050	MO 207/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Beryllium	0.5	2.8
3741050	MO 207/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Cadmium	0.5	4.8
3741050	MO 207/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Chromium	11	49.4
3741050	MO 207/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Cobalt	3.8	51.3
3741050	MO 207/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Copper	5	185
3741050	MO 207/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Lead	1.9	376
3741050	MO 207/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Nickel	14	28.7
3741050	MO 207/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Silver	0.3	1.5
3741050	MO 207/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Thallium	0.5	1.0
3741050	MO 207/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Vanadium	3.9	70.2
3741050	MO 207/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Zinc	160	1090
3741051	MO 207/400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Arsenic	13	32.7
3741051	MO 207/400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Beryllium	0.5	3.4
3741051	MO 207/400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Cadmium	0.5	3.5
3741051	MO 207/400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Chromium	11	42.5
3741051	MO 207/400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Cobalt	3.8	51.2
3741051	MO 207/400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Copper	5	123
3741051	MO 207/400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Lead	1.9	146
3741051	MO 207/400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Nickel	14	40.7
3741051	MO 207/400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Silver	0.3	3.7
3741051	MO 207/400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Thallium	0.5	0.9
3741051	MO 207/400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Vanadium	3.9	43.0
3741052	FE 103/400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Zinc	160	312
3741052	FE 103/400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Antimony	1.5	8.3
3741052	FE 103/400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Arsenic	13	211
3741052	FE 103/400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Barium	610	864
3741052	FE 103/400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Beryllium	0.5	0.7
3741052	FE 103/400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Cadmium	0.5	5.0
3741052	FE 103/400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Chromium	11	42.2
3741052	FE 103/400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Cobalt	3.8	8.4
3741052	FE 103/400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Copper	5	222
3741052	FE 103/400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Lead	1.9	172
3741052	FE 103/400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Nickel	14	18.3



AGAT Laboratories

Guideline Violation

AGAT WORK ORDER: 12T645174

PROJECT NO: 12-1152-0166

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CLIENT NAME: GOLDER ASSOCIATES LTD.

ATTENTION TO: Andrea Amendola

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	GUIDEVALUE	RESULT
3741052	FE 103/400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Silver	0.3	41.6
3741052	FE 103/400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Thallium	0.5	1.5
3741052	FE 103/400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Vanadium	3.9	30.0
3741052	FE 103/400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Zinc	160	439
3741053	FE 103/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Antimony	1.5	1.8
3741053	FE 103/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Arsenic	13	41.9
3741053	FE 103/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Barium	610	825
3741053	FE 103/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Beryllium	0.5	1.6
3741053	FE 103/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Cadmium	0.5	6.0
3741053	FE 103/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Chromium	11	43.8
3741053	FE 103/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Cobalt	3.8	16.4
3741053	FE 103/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Copper	5	239
3741053	FE 103/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Lead	1.9	425
3741053	FE 103/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Nickel	14	44.5
3741053	FE 103/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Silver	0.3	3.5
3741053	FE 103/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Vanadium	3.9	32.8
3741054	Blank1	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Zinc	160	923
3741054	Blank1	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Cadmium	0.5	2.4
3741054	Blank1	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Chromium	11	18.7
3741054	Blank1	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Copper	5	41.4
3741054	Blank1	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Lead	1.9	66.2
3741054	Blank1	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Vanadium	3.9	7.4
3741055	Blank2	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Chromium	11	25.6
3741055	Blank2	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Copper	5	88.7
3741055	Blank2	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Lead	1.9	9.1
3741055	Blank2	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Nickel	14	73.5
3741055	Blank2	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Vanadium	3.9	10.1
3741056	EN 409/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Arsenic	13	16.7
3741056	EN 409/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Barium	610	627
3741056	EN 409/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Beryllium	0.5	2.6
3741056	EN 409/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Cadmium	0.5	2.2
3741056	EN 409/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Chromium	11	45.8
3741056	EN 409/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Cobalt	3.8	22.8
3741056	EN 409/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Copper	5	165
3741056	EN 409/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Lead	1.9	201
3741056	EN 409/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Nickel	14	24.5
3741056	EN 409/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Silver	0.3	1.1
3741056	EN 409/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Vanadium	3.9	45.7
3741056	EN 409/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Zinc	160	409
3741057	Qu 1101/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Antimony	1.5	5.8
3741057	Qu 1101/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Arsenic	13	1100
3741057	Qu 1101/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Barium	610	1700
3741057	Qu 1101/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Beryllium	0.5	2.8



AGAT Laboratories

Guideline Violation

AGAT WORK ORDER: 12T645174

PROJECT NO: 12-1152-0166

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: GOLDER ASSOCIATES LTD.

ATTENTION TO: Andrea Amendola

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	GUIDEVALUE	RESULT
3741057	Qu 1101/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Cadmium	0.5	9.6
3741057	Qu 1101/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Chromium	11	95.8
3741057	Qu 1101/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Cobalt	3.8	38.7
3741057	Qu 1101/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Copper	5	631
3741057	Qu 1101/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Lead	1.9	2520
3741057	Qu 1101/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Nickel	14	46.3
3741057	Qu 1101/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Silver	0.3	5.5
3741057	Qu 1101/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Thallium	0.5	2.1
3741057	Qu 1101/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Vanadium	3.9	61.7
3741057	Qu 1101/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Zinc	160	4240
3741058	Ku 209/400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Antimony	1.5	5.7
3741058	Ku 209/400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Arsenic	13	119
3741058	Ku 209/400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Beryllium	0.5	1.6
3741058	Ku 209/400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Cadmium	0.5	2.8
3741058	Ku 209/400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Chromium	11	49.2
3741058	Ku 209/400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Cobalt	3.8	7.5
3741058	Ku 209/400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Copper	5	209
3741058	Ku 209/400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Lead	1.9	1290
3741058	Ku 209/400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Nickel	14	26.3
3741058	Ku 209/400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Silver	0.3	2.4
3741058	Ku 209/400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Vanadium	3.9	42.5
3741058	Ku 209/400-500	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Zinc	160	687
3741059	Dup Qu 1101/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Antimony	1.5	5.4
3741059	Dup Qu 1101/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Arsenic	13	1140
3741059	Dup Qu 1101/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Barium	610	1740
3741059	Dup Qu 1101/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Beryllium	0.5	2.7
3741059	Dup Qu 1101/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Cadmium	0.5	10.4
3741059	Dup Qu 1101/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Chromium	11	97.1
3741059	Dup Qu 1101/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Cobalt	3.8	40.9
3741059	Dup Qu 1101/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Copper	5	647
3741059	Dup Qu 1101/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Lead	1.9	2490
3741059	Dup Qu 1101/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Nickel	14	65.2
3741059	Dup Qu 1101/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Silver	0.3	5.5
3741059	Dup Qu 1101/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Thallium	0.5	2.3
3741059	Dup Qu 1101/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Vanadium	3.9	65.5
3741059	Dup Qu 1101/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Zinc	160	4370
3741060	DI water	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Copper	5	123
3741060	DI water	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Vanadium	3.9	7.4
3741061	Montana 2711	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Antimony	1	10.9
3741061	Montana 2711	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Arsenic	11	93
3741061	Montana 2711	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Cadmium	1	36.7
3741061	Montana 2711	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Copper	62	95
3741061	Montana 2711	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Lead	45	1050



AGAT Laboratories

Guideline Violation

AGAT WORK ORDER: 12T645174

PROJECT NO: 12-1152-0166

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CLIENT NAME: GOLDER ASSOCIATES LTD.

ATTENTION TO: Andrea Amendola

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	GUIDEVALUE	RESULT
3741061	Montana 2711	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Selenium	1.2	1.6
3741061	Montana 2711	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Silver	0.5	4.0
3741061	Montana 2711	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Thallium	1	1.6
3741061	Montana 2711	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Zinc	290	322
3741072	Montana 2711A	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Antimony	1	14.2
3741072	Montana 2711A	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Arsenic	11	106
3741072	Montana 2711A	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Barium	210	214
3741072	Montana 2711A	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Cadmium	1	50.7
3741072	Montana 2711A	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Copper	62	124
3741072	Montana 2711A	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Lead	45	1340
3741072	Montana 2711A	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Selenium	1.2	1.7
3741072	Montana 2711A	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Silver	0.5	6.1
3741072	Montana 2711A	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Thallium	1	2.1
3741072	Montana 2711A	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Zinc	290	411
3741073	EN 409/400-500	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Antimony	1	4.1
3741073	EN 409/400-500	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Arsenic	11	49
3741073	EN 409/400-500	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Selenium	1.2	1.3
3741074	Qu 1101-400-500	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Antimony	1	7.0
3741074	Qu 1101-400-500	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Arsenic	11	171
3741074	Qu 1101-400-500	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Barium	210	284
3741074	Qu 1101-400-500	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Boron	36	265
3741074	Qu 1101-400-500	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Copper	62	104
3741074	Qu 1101-400-500	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Lead	45	214
3741074	Qu 1101-400-500	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Molybdenum	2	2.4
3741074	Qu 1101-400-500	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Silver	0.5	0.6
3741075	MO 207/0-100	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Antimony	1	1.8
3741075	MO 207/0-100	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Arsenic	11	51
3741075	MO 207/0-100	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Lead	45	66
3741076	MO 207/400-500	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Antimony	1	4.9
3741076	MO 207/400-500	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Arsenic	11	158
3741076	MO 207/400-500	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Molybdenum	2	3.1
3741076	MO 207/400-500	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Selenium	1.2	1.4
3741077	FE 103/400-500	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Antimony	1	38.9
3741077	FE 103/400-500	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Arsenic	11	915
3741077	FE 103/400-500	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Barium	210	329
3741077	FE 103/400-500	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Copper	62	68
3741077	FE 103/400-500	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Lead	45	326
3741077	FE 103/400-500	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Molybdenum	2	6.9
3741077	FE 103/400-500	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Selenium	1.2	2.4
3741077	FE 103/400-500	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Silver	0.5	10.9
3741077	FE 103/400-500	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Thallium	1	8.6
3741078	FE 103/0-100	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Antimony	1	5.6
3741078	FE 103/0-100	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Arsenic	11	95



AGAT Laboratories

Guideline Violation

AGAT WORK ORDER: 12T645174

PROJECT NO: 12-1152-0166

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CLIENT NAME: GOLDER ASSOCIATES LTD.

ATTENTION TO: Andrea Amendola

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	GUIDEVALUE	RESULT
3741078	FE 103/0-100	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Lead	45	119
3741078	FE 103/0-100	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Silver	0.5	0.7
3741079	Qu 110/1/0-100	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Antimony	1	21.7
3741079	Qu 110/1/0-100	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Arsenic	11	364
3741079	Qu 110/1/0-100	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Barium	210	325
3741079	Qu 110/1/0-100	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Cadmium	1	1.2
3741079	Qu 110/1/0-100	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Copper	62	152
3741079	Qu 110/1/0-100	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Lead	45	518
3741079	Qu 110/1/0-100	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Molybdenum	2	2.6
3741079	Qu 110/1/0-100	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Selenium	1.2	1.4
3741079	Qu 110/1/0-100	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Silver	0.5	1.1
3741079	Qu 110/1/0-100	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Thallium	1	1.3
3741079	Qu 110/1/0-100	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Zinc	290	669
3741080	Ku 209/400-500	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Antimony	1	16.1
3741080	Ku 209/400-500	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Arsenic	11	288
3741080	Ku 209/400-500	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Lead	45	322
3741080	Ku 209/400-500	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Molybdenum	2	2.3
3741080	Ku 209/400-500	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Silver	0.5	1.3
3741080	Ku 209/400-500	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Thallium	1	3.1
3741081	Ku 209/0-100	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Antimony	1	8.2
3741081	Ku 209/0-100	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Arsenic	11	101
3741081	Ku 209/0-100	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Barium	210	274
3741081	Ku 209/0-100	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Cadmium	1	1.2
3741081	Ku 209/0-100	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Copper	62	102
3741081	Ku 209/0-100	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Lead	45	797
3741081	Ku 209/0-100	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Molybdenum	2	2.2
3741081	Ku 209/0-100	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Zinc	290	422
3741083	EN 409/0-100	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Antimony	1	2.0
3741083	EN 409/0-100	T1(AG) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Soil)	Arsenic	11	26
3741084	Ku 209/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Antimony	1.5	4.4
3741084	Ku 209/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Arsenic	13	141
3741084	Ku 209/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Barium	610	1780
3741084	Ku 209/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Beryllium	0.5	3.4
3741084	Ku 209/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Cadmium	0.5	11.2
3741084	Ku 209/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Chromium	11	79.1
3741084	Ku 209/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Cobalt	3.8	23.5
3741084	Ku 209/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Copper	5	599
3741084	Ku 209/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Lead	1.9	3970
3741084	Ku 209/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Nickel	14	69.5
3741084	Ku 209/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Silver	0.3	3.1
3741084	Ku 209/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Thallium	0.5	0.6
3741084	Ku 209/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Vanadium	3.9	44.2
3741084	Ku 209/0-100	T1(ALL GW) - Current	O. Reg. 153(511) - Metals (Comprehensive) (Water)	Zinc	160	2230

Quality Assurance

CLIENT NAME: GOLDER ASSOCIATES LTD.
 PROJECT NO: 12-1152-0166

AGAT WORK ORDER: 12T645174
 ATTENTION TO: Andrea Amendola

Soil Analysis

RPT Date: Oct 01, 2012 DUPLICATE REFERENCE MATERIAL METHOD BLANK SPIKE MATRIX SPIKE

PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value		Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
							Lower	Upper	Lower	Upper		Lower	Upper			

O. Reg. 153(511) - Metals (Comprehensive) (Soil)																
Antimony	1	3741061	10.9	11.0	0.9%	< 0.8	120%	70%	130%	102%	80%	120%	99%	70%	130%	
Arsenic	1	3741061	93	101	8.2%	< 1	101%	70%	130%	101%	80%	120%	99%	70%	130%	
Boron	1	3741061	8	8	0.0%	< 5	74%	70%	130%	114%	80%	120%	107%	70%	130%	
Barium	1	3741061	193	204	5.5%	< 2	105%	70%	130%	111%	80%	120%	98%	70%	130%	
Beryllium	1	3741061	1.0	1.1	9.5%	< 0.5	113%	70%	130%	108%	80%	120%	105%	70%	130%	
Cadmium	1	3741061	36.7	39.3	6.8%	< 0.5	101%	70%	130%	100%	80%	120%	110%	70%	130%	
Chromium	1	3741061	20	22	9.5%	< 2	99%	70%	130%	104%	80%	120%	99%	70%	130%	
Cobalt	1	3741061	7.7	8.2	6.3%	< 0.5	96%	70%	130%	101%	80%	120%	95%	70%	130%	
Copper	1	3741061	95	105	10.0%	< 1	100%	70%	130%	104%	80%	120%	113%	70%	130%	
Lead	1	3741061	1050	1110	5.6%	< 1	100%	70%	130%	105%	80%	120%	105%	70%	130%	
Molybdenum	1	3741061	1.2	1.3	8.0%	< 0.5	97%	70%	130%	108%	80%	120%	99%	70%	130%	
Nickel	1	3741061	15	17	12.5%	< 1	94%	70%	130%	102%	80%	120%	99%	70%	130%	
Selenium	1	3741061	1.6	1.5	6.5%	< 0.4	99%	70%	130%	98%	80%	120%	97%	70%	130%	
Silver	1	3741061	4.0	4.4	9.5%	< 0.2	80%	70%	130%	106%	80%	120%	114%	70%	130%	
Thallium	1	3741061	1.6	1.7	6.1%	< 0.4	106%	70%	130%	94%	80%	120%	95%	70%	130%	
Uranium	1	3741061	0.9	1.0	10.5%	< 0.5	97%	70%	130%	100%	80%	120%	95%	70%	130%	
Vanadium	1	3741061	41	46	11.5%	< 1	105%	70%	130%	102%	80%	120%	94%	70%	130%	
Zinc	1	3741061	322	353	9.2%	< 5	101%	70%	130%	113%	80%	120%	105%	70%	130%	

Certified By: _____



AGAT Laboratories is accredited to ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA) and/or Standards Council of Canada (SCC) for specific tests listed on the scope of accreditation. AGAT Laboratories (Mississauga) is also accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) for specific drinking water tests. Accreditations are location and parameter specific. A complete listing of parameters for each location is available from www.cala.ca and/or www.scc.ca. The tests in this report may not necessarily be included in the scope of accreditation.

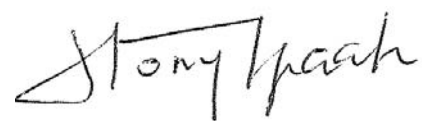
Quality Assurance

CLIENT NAME: GOLDER ASSOCIATES LTD.
 PROJECT NO: 12-1152-0166

AGAT WORK ORDER: 12T645174
 ATTENTION TO: Andrea Amendola

Water Analysis															
RPT Date: Oct 01, 2012			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - Metals (Comprehensive) (Water)															
Antimony	1	3741084	4.4	5.0	12.8%	< 0.5	103%	70%	130%	100%	80%	120%	100%	70%	130%
Arsenic	1	3741084	141	142	0.7%	< 1.0	99%	70%	130%	97%	80%	120%	102%	70%	130%
Barium	1	3741084	1780	1740	2.3%	< 2.0	99%	70%	130%	99%	80%	120%	99%	70%	130%
Beryllium	1	3741084	3.37	3.20	5.2%	< 0.5	105%	70%	130%	103%	80%	120%	98%	70%	130%
Boron	1	3741084	40.0	36.5	9.2%	< 10.0	104%	70%	130%	103%	80%	120%	103%	70%	130%
Cadmium	1	3741084	11.2	10.4	7.4%	< 0.2	100%	70%	130%	101%	80%	120%	103%	70%	130%
Chromium	1	3741084	79.1	79.7	0.8%	< 2.0	100%	70%	130%	101%	80%	120%	101%	70%	130%
Cobalt	1	3741084	23.5	24.1	2.5%	< 0.5	107%	70%	130%	103%	80%	120%	98%	70%	130%
Copper	1	3741084	599	595	0.7%	< 1.0	100%	70%	130%	96%	80%	120%	102%	70%	130%
Lead	1	3741084	3970	4020	1.3%	< 0.5	93%	70%	130%	91%	80%	120%	89%	70%	130%
Molybdenum	1	3741084	2.1	2.4	13.3%	< 0.5	97%	70%	130%	95%	80%	120%	100%	70%	130%
Nickel	1	3741084	69.5	71.3	2.6%	< 1.0	105%	70%	130%	103%	80%	120%	103%	70%	130%
Selenium	1	3741084	< 1.0	< 1.0	0.0%	< 1.0	99%	70%	130%	96%	80%	120%	102%	70%	130%
Silver	1	3741084	3.08	2.84	8.1%	< 0.2	101%	70%	130%	108%	80%	120%	106%	70%	130%
Thallium	1	3741084	0.6	0.7	15.4%	< 0.3	101%	70%	130%	106%	80%	120%	96%	70%	130%
Uranium	1	3741084	6.1	6.1	0.0%	< 0.5	105%	70%	130%	101%	80%	120%	99%	70%	130%
Vanadium	1	3741084	44.2	51.5	15.3%	< 0.4	101%	70%	130%	98%	80%	120%	101%	70%	130%
Zinc	1	3741084	2230	2260	1.3%	< 5.0	100%	70%	130%	109%	80%	120%	102%	70%	130%

Certified By: _____



Method Summary

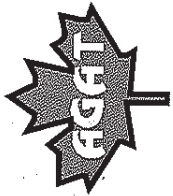
CLIENT NAME: GOLDER ASSOCIATES LTD.

AGAT WORK ORDER: 12T645174

PROJECT NO: 12-1152-0166

ATTENTION TO: Andrea Amendola

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Antimony	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Arsenic	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Boron	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Barium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Beryllium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Cadmium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Cobalt	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Copper	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Lead	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Molybdenum	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Nickel	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Selenium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Silver	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Thallium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Uranium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Vanadium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Zinc	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Water Analysis			
Antimony	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Arsenic	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Barium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Beryllium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Boron	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Cadmium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Chromium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Cobalt	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Copper	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Lead	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Molybdenum	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Nickel	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Selenium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Silver	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Thallium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Uranium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Vanadium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Zinc	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS



CHAIN OF CUSTODY RECORD

AGAT Laboratories Limited
 5623 McAdam Road
 Mississauga, Ontario L4Z 1N9
 http://webearth.agatlabs.com

Phone: 905-501-9998
 Fax: 905-501-0589
 Toll free: 800-856-6261
 www.agatlabs.com

LABORATORY USE ONLY

Arrival Condition: Good Poor (complete "notes")
 Arrival Temperature: 94.9698
 AGAT Job Number: 939697
 Notes: ICE 12T64S174

Client Information

Company: Golder Associates
 Contact: Sharon Guin
 Address: 2390 Argentic Rd.
MISSISSAUGA
 Phone: 905-567-4444 Fax:
 PO #:
 Client Project #: 12-1152-0166
 AGAT Quotation #:

Report Information - reports to be sent to:

1. Name: Andrea Amendola
 Email: aamendola@golder.com
 2. Name: Sharon Guin
 Email: sguin@golder.com
 3. Name:
 Email:
 4. Name:
 Email:

Report Format

Single Sample per page
 Multiple Samples per page
 Excel Format Included

Turnaround Time (TAT) Required

Regular TAT:

5 to 7 Working Days

Rush TAT: (please provide prior notification)

3 to 5 days
 48 to 72 Hours
 24 to 48 hours

DATE REQUIRED: OCT 1/12

Regulatory Guideline Required:

Reg 153 Table (Indicate one)
 Sewer Use Region (Indicate one)
 PWQO
 Reg 558
 CCME
 Other (Indicate)
 Ind/Com Res/Park Ag
 Sanitary
 Storm

Is this a drinking water sample (potable water intended for human consumption)?
 Yes No
 If "Yes" please use the Drinking Water Chain of Custody Record.

Sample Identification	Date/Time Sampled	Sample Matrix	# of Containers	Comments- Site/ Sample Info. Sample Containment	Metals and Inorganics	Metals Scan (not incl. Hg, B, Cr6)	TCP Metals/Inorganics	TCP	Storm Sewer Use	Sanitary Sewer Use	CCME Fractions 1 to 4	VOCs	PAHs	PCBs
MONTANA 2711	9/23/12	Water	1	high chloride	X	X	X	X	X	X	X	X	X	X
MONTANA 271A	9/23/12	Water	1		X	X	X	X	X	X	X	X	X	X
EN 409/400-500	9/24/12	"	"		X	X	X	X	X	X	X	X	X	X
QU 1101/400-500	"	"	"		X	X	X	X	X	X	X	X	X	X
MD 207/0-100	"	"	"		X	X	X	X	X	X	X	X	X	X
MD 207/400-500	"	"	"		X	X	X	X	X	X	X	X	X	X
FE 103/400-500	"	"	"		X	X	X	X	X	X	X	X	X	X
FE 103/0-100	"	"	"		X	X	X	X	X	X	X	X	X	X
BLANK 1	"	"	"		X	X	X	X	X	X	X	X	X	X
BLANK 2	"	"	"		X	X	X	X	X	X	X	X	X	X
EN 409/0-100	"	"	"		X	X	X	X	X	X	X	X	X	X
QU 1101/0-100	"	"	"		X	X	X	X	X	X	X	X	X	X
Samples Relinquished By (print name & sign) <u>Jin Wang</u>				Date/Time <u>Sept 24/12</u>	Samples Received By (print name & sign) <u>Sime</u>									
Samples Relinquished By (print name & sign)				Date/Time <u>4/5</u>	Samples Received By (print name & sign) <u>4/5</u>									
Pink Copy - Client										PAGE 1 of 3		White Copy - AGAT		
Yellow Copy - AGAT										NO: 38085				

ICP-MS Metals



CHAIN OF CUSTODY RECORD

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 Fax: 905-501-0589
 Toll free: 800-856-6261
 www.agatlabs.com

LABORATORY USE ONLY

Arrival Condition: Good Poor (complete "notes")
 Arrival Temperature: _____
 AGAT Job Number: _____
 Notes: _____

Client Information

Company: Golden Associates
 Contact: Sharon Guin
 Address: 2290 Argentic Rd.
Mississauga
 Phone: 905-567-4444 Fax: _____
 PO #: _____
 Client Project #: 12-1152-0166
 AGAT Quotation #: _____

Report Information - reports to be sent to:

1. Name: Andree Amendola
 Email: aamendola@golder.com
 2. Name: Sharon Guin
 Email: sguin@golder.com
 3. Name: _____
 Email: _____
 4. Name: _____
 Email: _____

Report Format

Single Sample per page
 Multiple Samples per page
 Excel Format Included

Turnaround Time (TAT) Required

Regular TAT:

5 to 7 Working Days

Rush TAT: (please provide prior notification)

3 to 5 days
 48 to 72 Hours
 24 to 48 hours

DATE REQUIRED: 005/1/12

Regulatory Guideline Required:

Reg 153 Table (Indicate one)
 Sewer Use Region (Indicate one)
 Ind/Com Sanitary Storm
 PWQO Reg 558 CCME Other (indicate)

Is this a drinking water sample (potable water intended for human consumption)?
 Yes No
 If "Yes" please use the Drinking Water Chain of Custody Record

Sample Identification	Date/Time Sampled	Sample Matrix	# of Containers	Comments- Site/ Sample Info. Sample Containment	Metals and Inorganics	Metals Scan (not incl. Hg, B, Cr6)	TCP Metals/Inorganics	TCP	Storm Sewer Use	Sanitary Sewer Use	CCME Fractions 1 to 4	VOCs	PAHs	PCBs
KU 209/400-500	9/25/12	water	1	high chloride										
DUP 0110/0-100	9/24/12	"	"	"										
DI WATER	"	"	"	"										
MONTANA 2711	"	soil	"	empty bag bags										
MONTANA 2711A	"	"	"	"										
EN 409/400-500	"	"	"	"										
QU 1101/400-500	"	"	"	"										
ND 207/0-100	"	"	"	"										
MO 207/400-500	"	"	"	"										
PE 103/400-500	"	"	"	"										
PE 103/0-100	"	"	"	"										
QU 1101/0-100	"	"	"	"										
Samples Relinquished By (print name & sign) J. Mac Donnell / J. Macdonnell				Date/Time 4-11 Sept 24/12	Samples Received By (print name & sign) S. Guin / Sharon Guin									
Samples Relinquished By (print name & sign)				Date/Time	Samples Received By (print name & sign)									

Date/Time: 4/5
 Date/Time: 4/5

Pink Copy - Client
 Yellow Copy - AGAT
 White Copy - AGAT

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 NO: 38086

At Golder Associates we strive to be the most respected global company providing consulting, design, and construction services in earth, environment, and related areas of energy. Employee owned since our formation in 1960, our focus, unique culture and operating environment offer opportunities and the freedom to excel, which attracts the leading specialists in our fields. Golder professionals take the time to build an understanding of client needs and of the specific environments in which they operate. We continue to expand our technical capabilities and have experienced steady growth with employees who operate from offices located throughout Africa, Asia, Australasia, Europe, North America, and South America.

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South America	+ 55 21 3095 9500

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