



Environmental Division

Certificate of Analysis

AMEC EARTH & ENVIRONMENTAL
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Report Date: 11-JUL-09 16:01 (MT)
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Lab Work Order #: **L787325**

Date Received: **03-JUL-09**

Project P.O. #: 313306
Job Reference: EC-56411
Legal Site Desc:
CofC Numbers:

Other Information:

Comments:

MAUREEN OLINEK
Senior Account Manager

THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE WRITTEN AUTHORITY OF THE LABORATORY.
ALL SAMPLES WILL BE DISPOSED OF AFTER 30 DAYS FOLLOWING ANALYSIS. PLEASE CONTACT THE LAB IF YOU
REQUIRE ADDITIONAL SAMPLE STORAGE TIME.

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L787325-1 09-6620 (RA02-1) Sampled By: CLIENT Matrix: SOIL Total Organic Carbon -Inorg & Total C Inorganic and Organic Carbon								
Inorganic Carbon	<0.10		0.10	%	08-JUL-09	08-JUL-09	XHY	R859803
Total Organic Carbon	36.2		0.10	%	08-JUL-09	08-JUL-09	XHY	R859803
CaCO3 Equivalent	1.41		0.70	%	08-JUL-09	08-JUL-09	XHY	R859803
Total Carbon by Combustion	36.2		0.1	%	08-JUL-09	08-JUL-09	XHY	R860496
Total Nitrogen by LECO	1.45		0.020	%	08-JUL-09	08-JUL-09	XHY	R860496
L787325-2 09-6621 (RA3-1) Sampled By: CLIENT Matrix: SOIL Total Organic Carbon -Inorg & Total C Inorganic and Organic Carbon								
Inorganic Carbon	0.51		0.10	%	08-JUL-09	08-JUL-09	XHY	R859803
Total Organic Carbon	42.4		0.10	%	08-JUL-09	08-JUL-09	XHY	R859803
CaCO3 Equivalent	5.19		0.70	%	08-JUL-09	08-JUL-09	XHY	R859803
Total Carbon by Combustion	42.9		0.1	%	08-JUL-09	08-JUL-09	XHY	R860496
Total Nitrogen by LECO	1.19		0.020	%	08-JUL-09	08-JUL-09	XHY	R860496
L787325-3 09-6622 (RA3-2) Sampled By: CLIENT Matrix: SOIL Total Organic Carbon -Inorg & Total C Inorganic and Organic Carbon								
Inorganic Carbon	<0.10		0.10	%	08-JUL-09	08-JUL-09	XHY	R859803
Total Organic Carbon	26.5		0.10	%	08-JUL-09	08-JUL-09	XHY	R859803
CaCO3 Equivalent	1.14		0.70	%	08-JUL-09	08-JUL-09	XHY	R859803
Total Carbon by Combustion	26.5		0.1	%	08-JUL-09	08-JUL-09	XHY	R860496
Total Nitrogen by LECO	1.36		0.020	%	08-JUL-09	08-JUL-09	XHY	R860496
L787325-4 09-6623 (RA3-3) Sampled By: CLIENT Matrix: SOIL Total Organic Carbon -Inorg & Total C Inorganic and Organic Carbon								
Inorganic Carbon	<0.10		0.10	%	08-JUL-09	08-JUL-09	XHY	R859803
Total Organic Carbon	3.89		0.10	%	08-JUL-09	08-JUL-09	XHY	R859803
CaCO3 Equivalent	<0.70		0.70	%	08-JUL-09	08-JUL-09	XHY	R859803
Total Carbon by Combustion	3.9		0.1	%	08-JUL-09	08-JUL-09	XHY	R860496
Total Nitrogen by LECO	0.196		0.020	%	08-JUL-09	08-JUL-09	XHY	R860496
L787325-5 09-6625 (RA4-1) Sampled By: CLIENT Matrix: SOIL Total Organic Carbon -Inorg & Total C Inorganic and Organic Carbon								
Inorganic Carbon	0.14		0.10	%	08-JUL-09	08-JUL-09	XHY	R859803
Total Organic Carbon	43.0		0.10	%	08-JUL-09	08-JUL-09	XHY	R859803
CaCO3 Equivalent	2.01		0.70	%	08-JUL-09	08-JUL-09	XHY	R859803
Total Carbon by Combustion	43.1		0.1	%	08-JUL-09	08-JUL-09	XHY	R860496

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L787325-10 09-6631 (RA5-3) Sampled By: CLIENT Matrix: SOIL Total Organic Carbon -Inorg & Total C Inorganic and Organic Carbon								
Inorganic Carbon	<0.10		0.10	%	08-JUL-09	08-JUL-09	XHY	R859803
Total Organic Carbon	3.76		0.10	%	08-JUL-09	08-JUL-09	XHY	R859803
CaCO3 Equivalent	<0.70		0.70	%	08-JUL-09	08-JUL-09	XHY	R859803
Total Carbon by Combustion	3.8		0.1	%	08-JUL-09	08-JUL-09	XHY	R860496
Total Nitrogen by LECO	0.165		0.020	%	08-JUL-09	08-JUL-09	XHY	R860496
L787325-11 09-6633 (RA6-1) Sampled By: CLIENT Matrix: SOIL Total Organic Carbon -Inorg & Total C Inorganic and Organic Carbon								
Inorganic Carbon	<0.10		0.10	%	08-JUL-09	08-JUL-09	XHY	R859803
Total Organic Carbon	30.4		0.10	%	08-JUL-09	08-JUL-09	XHY	R859803
CaCO3 Equivalent	1.66		0.70	%	08-JUL-09	08-JUL-09	XHY	R859803
Total Carbon by Combustion	30.4		0.1	%	08-JUL-09	08-JUL-09	XHY	R860496
Total Nitrogen by LECO	1.26		0.020	%	08-JUL-09	08-JUL-09	XHY	R860496
L787325-12 09-6634 (RA6-2) Sampled By: CLIENT Matrix: SOIL Total Organic Carbon -Inorg & Total C Inorganic and Organic Carbon								
Inorganic Carbon	<0.10		0.10	%	08-JUL-09	08-JUL-09	XHY	R859803
Total Organic Carbon	31.0		0.10	%	08-JUL-09	08-JUL-09	XHY	R859803
CaCO3 Equivalent	0.82		0.70	%	08-JUL-09	08-JUL-09	XHY	R859803
Total Carbon by Combustion	31.0		0.1	%	08-JUL-09	08-JUL-09	XHY	R860496
Total Nitrogen by LECO	1.97		0.020	%	08-JUL-09	08-JUL-09	XHY	R860496
L787325-13 09-6635 (RA6-3) Sampled By: CLIENT Matrix: SOIL Total Organic Carbon -Inorg & Total C Inorganic and Organic Carbon								
Inorganic Carbon	0.14		0.10	%	08-JUL-09	08-JUL-09	XHY	R859803
Total Organic Carbon	31.9		0.10	%	08-JUL-09	08-JUL-09	XHY	R859803
CaCO3 Equivalent	1.99		0.70	%	08-JUL-09	08-JUL-09	XHY	R859803
Total Carbon by Combustion	32.1		0.1	%	08-JUL-09	08-JUL-09	XHY	R860496
Total Nitrogen by LECO	2.20		0.020	%	08-JUL-09	08-JUL-09	XHY	R860496
L787325-14 09-6638 (RA7-1) Sampled By: CLIENT Matrix: SOIL Total Organic Carbon -Inorg & Total C Inorganic and Organic Carbon								
Inorganic Carbon	<0.10		0.10	%	08-JUL-09	08-JUL-09	XHY	R859803
Total Organic Carbon	4.62		0.10	%	08-JUL-09	08-JUL-09	XHY	R859803
CaCO3 Equivalent	<0.70		0.70	%	08-JUL-09	08-JUL-09	XHY	R859803
Total Carbon by Combustion	4.6		0.1	%	08-JUL-09	08-JUL-09	XHY	R860496

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L787325-14 09-6638 (RA7-1) Sampled By: CLIENT Matrix: SOIL Total Nitrogen by LECO	0.318		0.020	%	08-JUL-09	08-JUL-09	XHY	R860496
L787325-15 09-6639 (RA7-2) Sampled By: CLIENT Matrix: SOIL Total Organic Carbon -Inorg & Total C Inorganic and Organic Carbon Inorganic Carbon Total Organic Carbon CaCO3 Equivalent Total Carbon by Combustion Total Nitrogen by LECO	 <0.10 2.16 <0.70 2.2 0.175		 0.10 0.10 0.70 0.1 0.020	 % % % % %	 08-JUL-09 08-JUL-09 08-JUL-09 08-JUL-09 08-JUL-09	 08-JUL-09 08-JUL-09 08-JUL-09 08-JUL-09 08-JUL-09	 XHY XHY XHY XHY XHY	 R859803 R859803 R859803 R860496 R860496
L787325-16 09-6640 (RA7-3) Sampled By: CLIENT Matrix: SOIL Total Organic Carbon -Inorg & Total C Inorganic and Organic Carbon Inorganic Carbon Total Organic Carbon CaCO3 Equivalent Total Carbon by Combustion Total Nitrogen by LECO	 <0.10 0.95 <0.70 1.0 0.099		 0.10 0.10 0.70 0.1 0.020	 % % % % %	 08-JUL-09 08-JUL-09 08-JUL-09 08-JUL-09 08-JUL-09	 08-JUL-09 08-JUL-09 08-JUL-09 08-JUL-09 08-JUL-09	 XHY XHY XHY XHY XHY	 R859803 R859803 R859803 R860496 R860496
* Refer to Referenced Information for Qualifiers (if any) and Methodology.								

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Preparation Method Reference(Based On)	Analytical Method Reference(Based On)
C-INORG-ORG-SK	Soil	Inorganic and Organic Carbon		SSSA (1996) P455-456

When carbonates are decomposed with acid in an open system, carbon dioxide is released to the atmosphere. The decrease in sample weight resulting from CO₂ loss is proportional to the carbonate content of the soil.

Reference:

Loeppert, R.H. and Suarez, D.L. 1996. Gravimetric Method for Loss of Carbon Dioxide. P. 455-456 In: J.M. Bartels et al. (ed.) Methods of soil analysis: Part 3 Chemical methods. (3rd ed.) ASA and SSSA, Madison, WI. Book series no. 5

C-TOT-LECO-SK	Soil	Total Carbon by combustion method		SSSA (1996) P. 973-974
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The sample is introduced into a quartz tube where it undergoes combustion at 900 °C in the presence of oxygen. Combustion gases are first carried through a catalyst bed in the bottom of the combustion tube, where oxidation is completed and then carried through a reducing agent (copper), where the nitrogen oxides are reduced to elemental nitrogen. This mixture of N₂, CO₂, and H₂O is then passed through an absorber column containing magnesium perchlorate to remove water. N₂ and CO₂ gases are then separated in a gas chromatographic column and detected by thermal conductivity.

Reference:

Nelson, D.W. and Sommers, L.E. 1996. Total Carbon, organic carbon and organic matter. P. 973-974 In: J.M. Bartels et al. (ed.) Methods of soil analysis: Part 3 Chemical methods. (3rd ed.) ASA and SSSA, Madison, WI. Book series no. 5

N-TOT-LECO-SK	Soil	Total Nitrogen by combustion method		SSSA (1996) p. 973-974
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The sample is introduced into a quartz tube where it undergoes combustion at 900 °C in the presence of oxygen. Combustion gases are first carried through a catalyst bed in the bottom of the combustion tube, where oxidation is completed and then carried through a reducing agent (copper), where the nitrogen oxides are reduced to elemental nitrogen. This mixture of N₂, CO₂, and H₂O is then passed through an absorber column containing magnesium perchlorate to remove water. N₂ and CO₂ gases are then separated in a gas chromatographic column and detected by thermal conductivity.

Reference: Bremner, J.M. 1996. Nitrogen - Total (Dumas Methods). P. 1088 In: J.M. Bartels et al. (ed.) Methods of soil analysis: Part 3 Chemical methods. (3rd ed.) ASA and SSSA, Madison, WI. Book series no. 5

** Laboratory Methods employed follow in-house procedures, which are generally based on nationally or internationally accepted methodologies.

Chain of Custody numbers:

The last two letters of the above test code(s) 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
SK	ALS LABORATORY GROUP - SASKATOON, SASKATCHEWAN, CANADA		

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 environmental 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. The Laboratory control limits are determined under column heading D.L.

mg/kg (units) - unit of concentration based on mass, parts per million.

mg/L (units) - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

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.

UNLESS OTHERWISE STATED, SAMPLES ARE NOT CORRECTED FOR CLIENT FIELD BLANKS.

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.