





June 19, 2017

File No. 16-0429-004

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Environmental Approvals Branch  
Manitoba Sustainable Development  
Suite 160, 123 Main Street  
Winnipeg, Manitoba  
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ATTENTION: Ms. Tracey Braun  
Director

RE: Environmental Act Licence No. 3201  
Notice of Alteration  
Town of Melita Land Application of Biosolids - File 108.30

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Dear Ms. Braun:

On behalf of the Manitoba Water Services Board and the Town of Melita, KGS Group has prepared this letter to update you on proposed project changes from the Environment Act Proposal (EAP) submitted August 11, 2016 for licencing approval to land apply biosolids. Environment Act License (EAL) No. 3201 was granted by Sustainable Development (SD) on October 26, 2016 for the operation of the Development being the removal of biosolids and sludge solids from the primary and secondary cells of the Town of Melita's wastewater treatment lagoon in the Municipality of Two Borders. Since the EAP was submitted there has been a proposed change to the project as a result of scheduling. Approval for a minor alteration to EAL No. 3201 was granted by SD on December 20, 2016. The minor alteration allowed the biosolids from the Primary cell to be stored in the Tertiary cell over the winter to facilitate upgrades to the Primary cell.

The current proposed changes to the application method is described in the paragraphs below. This Notice of Alteration is being provided for approval and inclusion in the project file.

#### Proposed Changes

Per the EAP, biosolids were proposed to be land applied in a slurry state by injection into the fields. As the biosolids were stockpiled over the winter, the moisture content of the biosolids has reduced significantly and presently is at around 22%. As such, it is proposed that rather than injecting the biosolids as a slurry, they will be broadcast upon the field from a spreader and will be incorporated into the soil using a disc or cultivator within two days of spreading. Application of the biosolids by spreader with incorporation into the soil within two days will not change the assessment of effects presented in the original EAP.

KGS Group contacted Mr. Asit Dey to notify SD of this proposed change. In an email addressed to KGS Group on June 16, Mr. Dey requested that we address several terms and conditions of EAL Licence No. 3201 in order to ensure compliance. The responses to each question are provided as follows.

- *Please comment on how the proposed application rate of biosolids complies with Clause 26 of Environment Act Licence No. 3201 (Licence).*

As the application method has changed and the biosolids will now be applied as a solid rather than a slurry, the metals loading, nitrogen and phosphorus application rates have been recalculated (Attachment 1). The proposed nitrogen application rate for the primary cell is 45 tons/acre for the receiving land within NW 25-3-27 as soil test phosphorus is below 60 ppm.

- *Please comment on whether the sludge sample analyzed is a representative sample in accordance with Clause 1 of Schedule "A" of the Licence.*

The biosolid sample is representative of the biosolids in Cell 1 and the method used to sample the biosolids from the primary and secondary cell was noted in Section 5.1 of EAP Appendix B.

- *The Sludge Sample analysis report (Page 2 of 4) does not report total phosphorus and TKN. Please update the report in accordance with Clause 2 of Schedule A of the Licence.*

The information provided to Mr. Dey contained some errors. The application rate has been recalculated by Tone Ag Consulting based upon the 2016 ALS Certificate of Analysis (COA, Lab Work Order # L1781394) which was included in the EAP as part of Appendix B. This COA includes total phosphorus and TKN. Additional information relating to total phosphorus and TKN is enclosed as Attachment 1. The sludge sample analysis that was submitted with the EAP is enclosed as Attachment 2.

- *At the end of the report, there is a table with a title "Steinbach Biosolids Characteristics and Analysis". Please comment on whether the biosolids characteristics and analysis table, in fact, represents the characteristics and analysis of Town of Melita biosolids. If not, then please update the table accordingly.*

The information provided to Mr. Dey contained some errors and the table referred to in the comment was the incorrect table. Please refer to Attachment 1 and Attachment 2.

- *The above table also contains information on total Phosphorus and TKN, which was not present in the original Biosolids and sludge solids sample analysis report. Clause 2 of Schedule A of the Licence states that the total phosphorous shall be analyzed by very strong acid digestion in accordance with EPA 3050 b or EPA 200.2. Please comment on whether the total phosphorous was analyzed in accordance with Clause 2 of the Schedule A of the Licence.*

The enclosed COA for the Primary cell indicates that TKN is 5,300 mg/kg and that total phosphorus is 5,440 mg/kg. On page 6 of 8 of the COA it is noted that the metals analysis was done using a very strong acid digestion.

- *You are required to include a discussion section in addition to the results of biosolids and sludge solids sample analysis in your report. The discussion section should include how the relevant licence terms and conditions were met. The above discussion section will greatly help us speeding up our review.*

The biosolid sampling procedure is described in the EAP Appendix B, Section 5.1 and the biosolid quality is described in Section 5.3. An updated application rate, based on spreading the biosolids with incorporation within two days is included in Attachment 1, Table 11.

Since the EAP was submitted, random composite sampling was conducted at the fields proposed to receive the biosolids application. The ALS Labs COA for the field samples dated October 11, 2016 is enclosed as Attachment 3.

Unless otherwise noted, the contractor applying the biosolids, Assiniboine Injections, will comply with all of the terms of the Environment Act Licence. Specific terms and conditions of the license that have been or will be met are as follows:

- Clause 2. All sampling has been carried out as prescribed and analyses were carried out by ALS laboratories in Winnipeg.
- Clause 4: The biosolids were removed from the primary and secondary cells and stockpiled over winter allowing much of the water to decant from them. As the biosolids are more solid than slurry, they will be applied to the surface of the fields. The biosolids will be incorporated into the fields within two days of application in order to eliminate or mitigate an odour nuisance.
- Clause 8. A land ownership agreement with Bert Kirkup to apply the biosolids is enclosed (Attachment 4). The certificate of title for the property has been ordered from the Land Titles Office and will be provided to SD prior to biosolid application.
- Clause 9. The contractor, Assiniboine Injections, will comply with the requirements of Manitoba Regulation 62/2008 during biosolid application.
- Clause 12. As described in the enclosed email from Mike at Assiniboine Injections (Attachment 5), the biosolids will be transported from the lagoon to the field using sealed end dumps and then spread with a real time scale system spreader for accurate spreading and mapping. Within 48 hours the biosolids will be incorporated with a disc or deep tiller.
- Clause 16. On June 13, 2017, Peter Crocker at Manitoba SD was notified of the intention to apply the biosolids.
- Clause 20. As the method of applying the biosolids has changed this Notice of Alteration form has been completed describing the alteration.
- Clause 21. As described in the EAP and in the enclosed updated biosolids application rate tables (Attachment 1), the residual Nitrogen and Phosphorus in the soil will comply with the Nutrient Management Regulation 62/208.
- Clause 23. KGS Group conducted a soil sampling program in June 2017 in order to determine that the field which would be subjected to biosolids application had a depth of clay or clay till of 1.5 metres or more between the soil surface and the water table (Attachment 6).
- Clause 26. The proposed application rate of the biosolids as described in the enclosed memorandum (Attachment 1) will be such that the cumulative weight of heavy metals does not exceed the values noted in Clause 26. Analysis of the field samples for heavy metals was done in accordance with Schedule B of the Licence.
- Clauses 28 and 29. The Licensee submitted the details of the biosolids sampling program in EAP Appendix B.

Should you require any additional information or have any questions regarding the Environment Act Proposal, please contact the undersigned at 204-896-1209.

Yours truly,

A handwritten signature in blue ink that reads "Gene Senior". The signature is written in a cursive, flowing style.

Gene Senior, M.A.  
Environmental Scientist

GS/jr

cc Mr. Bill Holden, Mayor, Town of Melita  
Ms. Sandra Anderson, Chief Administrative Officer, Town of Melita  
Travis Parsons, Manitoba Water Services Board  
Jaimee Schmidt, Manitoba Water Services Board



**ATTACHMENT 1**

**Table 8 – Biosolid Characteristics (Nitrogen and Phosphorus) for Primary and Secondary Cells – Based on June 2016 Sludge Samples**

Name	Description	Unit	Primary Cell Results	Secondary Cell Results
Volume (Plus 10%)	Field	m <sup>3</sup>	20,000	10,000
Specific Gravity	As Received	Kg/L	1.04	1.08
Moisture	As Received	%	92.8	84
<b>Nitrogen Characteristics</b>				
Total Kjeldahl N	% Dried Basis	%	0.53	0.68
Total Kjeldahl N	Dried Basis	mg/kg	5,300	6,800
Total Kjeldahl N	Dried Basis	kg/tonne	5.3	6.8
Ammonium N	Dried Basis	mg/kg	1,030	316
Ammonium N	Dried Basis	kg/tonne	1.03	0.32
Available Nitrate	Dried Basis	mg/kg	0	0
Available Nitrate-N	Dried Basis	mg/kg	0	0
Organic N	Dried Basis	mg/kg	4,270	6,484
Organic N	Dried Basis	kg/tonne	4.27	6.48
Application Method			Braodcast/Incorp	Braodcast/Incorp
Anticipated Weather			Cool/Dry	Cool/Dry
Anticipated Volatilization			35%	35%
Available Organic N	Dried Basis	kg/tonne	1.07	1.62
Available Ammonium N	Dried Basis	kg/tonne	0.67	0.21
Total Available N (Year 1)	Dried Basis	kg/tonne	1.74	1.83
Mineralization N (Year 2)	Dried Basis	kg/tonne	0.7	0.73
Mineralization N (Year 3)	Dried Basis	kg/tonne	0.35	0.37
<b>Phosphorus Characteristics</b>				
Total Phosphorus	Dried Basis	mg/kg	5,440	2,870
Total Phosphorus	Dried Basis	kg/tonne	5.44	2.87
P <sub>2</sub> O <sub>5</sub> (P * 2.3)	Dried Basis	kg/tonne	12.51	6.6
Total Available P <sub>2</sub> O <sub>5</sub>	Dried Basis	kg/tonne	0.769	0.189

Source: Tri-Provincial Manure Application and Use Guidelines, 2004 and MMM Group, 2013.

## 5.7 Soil Sampling

## 5.8 Proposed Application Rates

The target biosolids application rates for the primary and secondary cells will be based on the nitrogen requirement of either a cereal or oilseed crop (ie. spring wheat or canola). The target N rate will be 155 lbs/acre in order to grow a 55 bushel canola crop. Table 11 below shows the biosolids application rate based on N requirement and P2O5 crop removal for comparison.

**Table 11 – Application Rate Calculation Worksheet (Metric/Imperial Units)**

Name	Unit	Primary Cell	Secondary Cell
<b>Nitrogen Based Application Rate</b>			
Total Kjeldahl N	kg/tonne	0.53	0.68
Ammonium N	kg/tonne	1.03	0.32
Available Nitrate-N	kg/tonne	0	0
Organic N	kg/tonne	4.27	6.48
Application Method		Broadcast/Incorp	Broadcast/Incorp
Anticipated Weather		Cool/Dry	Cool/Dry
Anticipated Volatilization		35%	35%
Available Organic N	kg/tonne	1.07	1.62
Available Ammonium N	kg/tonne	0.67	0.21
Total Available N	kg/tonne	1.74	1.83
Total Available N	lbs/ton	3.48	3.66
N based Rate	tons/acre	<b>45</b>	<b>42</b>
Total N Applied	lbs/acre	155	155
Total P2O5	kg/tonne	12.51	6.6
Total Available P2O5	kg/tonne	0.769	0.189
Amount of Total P2O5 applied	lbs/acre	1125.9	554.4
Amount of Available P2O5 applied	lbs/acre	69.21	15.88
Crop Removal Rate	lbs/acre	47	47

Based on the application rate outlined in Table 11, the nitrogen application rates for both primary and secondary cells (45 and 42 tons/acre, respectively) are suitable for the receiving land within the PPA (NW 25-3-27W1) as soil test phosphorus is below 60 ppm (5 ppm).



Field 3 - NW 25-03-27W

Primary Cell - Based on June 2016 Sludge Samples

Trace Element	Primary Cell		Actual Soil Concentrations			Loading Rate @ 45 tons/acre		Cumulative Metal Concentration		Cumulative Weight Allowed by CCME Guidelines	
	mg/kg	kg/tonne	mg/kg	kg/ha	lbs/acre	kg/ha	lbs/acre	kg/ha	lbs/acre	kg/ha	lbs/acre
Arsenic (As)	4.37	0.00437	6.19	0.26	0.23	0.44	0.39	0.70	0.62	21.6	19.3
Cadmium (Cd)	2.28	0.00228	0.289	0.01	0.01	0.23	0.21	0.24	0.22	2.52	2.25
Chromium (Cr)	20	0.02	24	1.00	0.89	2.02	1.80	3.02	2.69	115.2	102.8
Copper (Cu)	602	0.602	11.1	0.46	0.41	60.73	54.18	61.19	54.59	113.4	101.2
Lead (Pb)	30.3	0.0303	5.7	0.24	0.21	3.06	2.73	3.29	2.94	126	112.4
Mercury (Hg)	0.337	0.000337	0.0312	0.00	0.00	0.03	0.03	0.04	0.03	11.9	10.6
Nickel (Ni)	19.4	0.0194	20.6	0.86	0.77	1.96	1.75	2.82	2.51	90	80.3
Zinc (Zn)	346	0.346	41	1.71	1.52	34.90	31.14	36.61	32.66	360	321.2

**ATTACHMENT 2**



KGS Group Consultants (Winnipeg)  
ATTN: Kenton Thiessen  
865 Waverly Street - 3rd Floor  
Winnipeg MB R3T 5P4

Date Received: 10-JUN-16  
Report Date: 24-JUN-16 15:17 (MT)  
Version: FINAL

Client Phone: 204-896-1209

## Certificate of Analysis

Lab Work Order #: L1781394  
Project P.O. #: NOT SUBMITTED  
Job Reference: 16-0429-004  
C of C Numbers:  
Legal Site Desc:

Hua Wo  
Chemistry Laboratory Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

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ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

## ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1781394-1 PRIMARY							
Sampled By: JO/AN on 09-JUN-16 @ 12:30							
Matrix: Sludge							
<b>Miscellaneous Parameters</b>							
Total Available Nitrogen	1030		98	mg/kg		17-JUN-16	
Boron (B), Hot Water Ext.	11.1	NSSM	4.0	mg/kg	16-JUN-16	16-JUN-16	R3481132
Note: Done as received and calculated to dry Available Phosphate-P	769	NSSM	10	mg/kg	16-JUN-16	16-JUN-16	R3482378
Note: Done as Received, back calc to dry Available Potassium	690		180	mg/kg	16-JUN-16	16-JUN-16	R3482495
Note: Done as Received, back calc to dry Available Sulfate-S	186	NSSM	84	mg/kg	16-JUN-16	16-JUN-16	R3482035
Note: Done as received and calculated to dry Chloride (Cl)	124	NSSM	1.0	mg/L	16-JUN-16	16-JUN-16	R3482533
Mercury (Hg)	0.337		0.050	mg/kg	13-JUN-16	14-JUN-16	R3479523
% Moisture	92.8		0.10	%	15-JUN-16	15-JUN-16	R3479722
% Saturation	Oversat		1.0	%	15-JUN-16	15-JUN-16	R3480699
Specific Gravity	1.04		0.010	kg/L		20-JUN-16	R3483558
Total Carbon by Combustion	1.71		0.05	%	15-JUN-16	15-JUN-16	R3480694
Total Kjeldahl Nitrogen	0.53	DLHC	0.20	%	21-JUN-16	21-JUN-16	R3486371
<b>Organic Matter by LOI at 375 deg C.</b>							
Organic Matter	8.4		1.0	%	17-JUN-16	17-JUN-16	R3483086
Loss on Ignition @ 375 C	10.4		1.0	%	17-JUN-16	17-JUN-16	R3483086
<b>Total Solids and Total Volatile Solids</b>							
Total Solids	8.03		0.10	%	17-JUN-16	17-JUN-16	R3482763
Total Volatile Solids (dry basis)	29.3		0.10	%	17-JUN-16	17-JUN-16	R3482763
<b>pH and Conductivity</b>							
pH	6.73		0.10	pH	15-JUN-16	15-JUN-16	R3480699
Conductivity (EC)	1.77		0.20	dS m-1	15-JUN-16	15-JUN-16	R3480699
<b>pH and EC (1:2 Soil:Water Extraction)</b>							
Conductivity (1:2)	1.35		0.050	dS m-1	17-JUN-16	17-JUN-16	R3482586
pH (1:2 soil:water)	8.14		0.10	pH	17-JUN-16	17-JUN-16	R3482586
<b>Detailed Salinity in dry-weight mg/kg</b>							
Chloride (Cl)	1600		13	mg/kg dwt		17-JUN-16	
Calcium (Ca)	1320		64	mg/kg dwt		17-JUN-16	
Magnesium (Mg)	942		64	mg/kg dwt		17-JUN-16	
Potassium (K)	221		64	mg/kg dwt		17-JUN-16	
Sodium (Na)	1270		64	mg/kg dwt		17-JUN-16	
Sulfur (as SO4)	258		64	mg/kg dwt		17-JUN-16	
<b>Detailed Salinity in wet-weight mg/kg</b>							
Chloride (Cl)	115		0.93	mg/kg wwt		17-JUN-16	
Calcium (Ca)	95.0		4.6	mg/kg wwt		17-JUN-16	
Magnesium (Mg)	67.8		4.6	mg/kg wwt		17-JUN-16	
Potassium (K)	15.9		4.6	mg/kg wwt		17-JUN-16	
Sodium (Na)	91.1		4.6	mg/kg wwt		17-JUN-16	
Sulfur (as SO4)	18.5		4.6	mg/kg wwt		17-JUN-16	
<b>Metals</b>							
Aluminum (Al)	13200		500	mg/kg	13-JUN-16	14-JUN-16	R3479690
Antimony (Sb)	1.34		0.10	mg/kg	13-JUN-16	14-JUN-16	R3479690
Arsenic (As)	4.37		0.10	mg/kg	13-JUN-16	14-JUN-16	R3479690
Barium (Ba)	360		0.50	mg/kg	13-JUN-16	14-JUN-16	R3479690
Beryllium (Be)	0.43		0.10	mg/kg	13-JUN-16	14-JUN-16	R3479690
Bismuth (Bi)	8.87		0.020	mg/kg	13-JUN-16	14-JUN-16	R3479690
Boron (B)	16		10	mg/kg	13-JUN-16	14-JUN-16	R3479690
Cadmium (Cd)	2.28		0.020	mg/kg	13-JUN-16	14-JUN-16	R3479690

\* Refer to Referenced Information for Qualifiers (if any) and Methodology.

## ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1781394-1 PRIMARY							
Sampled By: JO/AN on 09-JUN-16 @ 12:30							
Matrix: Sludge							
<b>Metals</b>							
Calcium (Ca)	94300		100	mg/kg	13-JUN-16	14-JUN-16	R3479690
Chromium (Cr)	20.0		1.0	mg/kg	13-JUN-16	14-JUN-16	R3479690
Cobalt (Co)	5.05		0.020	mg/kg	13-JUN-16	14-JUN-16	R3479690
Copper (Cu)	602		1.0	mg/kg	13-JUN-16	14-JUN-16	R3479690
Iron (Fe)	13500		25	mg/kg	13-JUN-16	14-JUN-16	R3479690
Lead (Pb)	30.3		0.20	mg/kg	13-JUN-16	14-JUN-16	R3479690
Magnesium (Mg)	11700		10	mg/kg	13-JUN-16	14-JUN-16	R3479690
Manganese (Mn)	485		0.50	mg/kg	13-JUN-16	14-JUN-16	R3479690
Molybdenum (Mo)	11.2		0.020	mg/kg	13-JUN-16	14-JUN-16	R3479690
Nickel (Ni)	19.4		0.50	mg/kg	13-JUN-16	14-JUN-16	R3479690
Phosphorus (P)	5440		100	mg/kg	13-JUN-16	14-JUN-16	R3479690
Potassium (K)	1890		25	mg/kg	13-JUN-16	14-JUN-16	R3479690
Selenium (Se)	13.5		0.50	mg/kg	13-JUN-16	14-JUN-16	R3479690
Silver (Ag)	4.52		0.10	mg/kg	13-JUN-16	14-JUN-16	R3479690
Sodium (Na)	1250		10	mg/kg	13-JUN-16	14-JUN-16	R3479690
Strontium (Sr)	312		0.10	mg/kg	13-JUN-16	14-JUN-16	R3479690
Thallium (Tl)	0.32		0.10	mg/kg	13-JUN-16	14-JUN-16	R3479690
Tin (Sn)	10.7		5.0	mg/kg	13-JUN-16	14-JUN-16	R3479690
Titanium (Ti)	36.7		0.50	mg/kg	13-JUN-16	14-JUN-16	R3479690
Uranium (U)	20.4		0.020	mg/kg	13-JUN-16	14-JUN-16	R3479690
Vanadium (V)	29.2		0.50	mg/kg	13-JUN-16	14-JUN-16	R3479690
Zinc (Zn)	346		10	mg/kg	13-JUN-16	14-JUN-16	R3479690
<b>Total Available N &amp; NO3-N, NO2-N &amp; NH4</b>							
<b>Available Ammonium-N</b>							
Available Ammonium-N	1030	NSSM	88	mg/kg	16-JUN-16	16-JUN-16	R3482481
Note: Done as Rec'd, back calc to dry							
<b>Nitrate, Nitrite &amp; Nitrate+Nitrite-N(KCL)</b>							
Nitrite-N	<8.8	NSSM	8.8	mg/kg	16-JUN-16	16-JUN-16	R3482594
Nitrate+Nitrite-N	<44	NSSM	44	mg/kg	16-JUN-16	16-JUN-16	R3482594
Nitrate-N	<44	NSSM	44	mg/kg	16-JUN-16	16-JUN-16	R3482594
Note: Done as Received, Back Calc to dry							
<b>Detailed Salinity -over sat'd waste</b>							
<b>SAR and Cations (over sat'd)</b>							
Calcium (Ca)	102		5.0	mg/L	16-JUN-16	16-JUN-16	R3481147
Potassium (K)	17.1		5.0	mg/L	16-JUN-16	16-JUN-16	R3481147
Magnesium (Mg)	73.1		5.0	mg/L	16-JUN-16	16-JUN-16	R3481147
Sodium (Na)	98.2		5.0	mg/L	16-JUN-16	16-JUN-16	R3481147
Sulfur (as SO4)	20.0		5.0	mg/L	16-JUN-16	16-JUN-16	R3481147
SAR	1.81		0.10	SAR	16-JUN-16	16-JUN-16	R3481147
L1781394-2 SECONDARY							
Sampled By: JO/AN on 09-JUN-16 @ 13:15							
Matrix: Sludge							
<b>Miscellaneous Parameters</b>							
Total Available Nitrogen	316		45	mg/kg		17-JUN-16	
Boron (B), Hot Water Ext.	9.7	NSSM	2.0	mg/kg	16-JUN-16	16-JUN-16	R3481132
Note: Done as received and calculated to dry							
Available Phosphate-P	189	NSSM	5.0	mg/kg	16-JUN-16	16-JUN-16	R3482378
Note: Done as Received, back calc to dry							
Available Potassium	723		80	mg/kg	16-JUN-16	16-JUN-16	R3482495
Note: Done as Received, back calc to dry							
Available Sulfate-S	222	NSSM	44	mg/kg	16-JUN-16	16-JUN-16	R3482035

\* Refer to Referenced Information for Qualifiers (if any) and Methodology.

# ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1781394-2 SECONDARY							
Sampled By: JO/AN on 09-JUN-16 @ 13:15							
Matrix: Sludge							
Note: Done as received and calculated to dry							
Chloride (Cl)	135	NSSM	1.0	mg/L	16-JUN-16	16-JUN-16	R3482533
Mercury (Hg)	0.151		0.050	mg/kg	13-JUN-16	14-JUN-16	R3479523
% Moisture	84.0		0.10	%	15-JUN-16	15-JUN-16	R3479722
% Saturation	Oversat		1.0	%	15-JUN-16	15-JUN-16	R3480699
Specific Gravity	1.08		0.010	kg/L		20-JUN-16	R3483558
Total Carbon by Combustion	2.10		0.05	%	15-JUN-16	15-JUN-16	R3480694
Total Kjeldahl Nitrogen	0.68	DLHC	0.40	%	21-JUN-16	21-JUN-16	R3486371
<b>Organic Matter by LOI at 375 deg C.</b>							
Organic Matter	10.1		1.0	%	17-JUN-16	17-JUN-16	R3483086
Loss on Ignition @ 375 C	12.6		1.0	%	17-JUN-16	17-JUN-16	R3483086
<b>Total Solids and Total Volatile Solids</b>							
Total Solids	11.8		0.10	%	17-JUN-16	17-JUN-16	R3482763
Total Volatile Solids (dry basis)	18.9		0.10	%	17-JUN-16	17-JUN-16	R3482763
<b>pH and Conductivity</b>							
pH	7.42		0.10	pH	15-JUN-16	15-JUN-16	R3480699
Conductivity (EC)	1.76		0.20	dS m-1	15-JUN-16	15-JUN-16	R3480699
<b>pH and EC (1:2 Soil:Water Extraction)</b>							
Conductivity (1:2)	1.32		0.050	dS m-1	17-JUN-16	17-JUN-16	R3482586
pH (1:2 soil:water)	8.27		0.10	pH	17-JUN-16	17-JUN-16	R3482586
<b>Detailed Salinity in dry-weight mg/kg</b>							
Chloride (Cl)	711		5.3	mg/kg dwt		17-JUN-16	
Calcium (Ca)	532		26	mg/kg dwt		17-JUN-16	
Magnesium (Mg)	451		26	mg/kg dwt		17-JUN-16	
Potassium (K)	109		26	mg/kg dwt		17-JUN-16	
Sodium (Na)	611		26	mg/kg dwt		17-JUN-16	
Sulfur (as SO4)	173		26	mg/kg dwt		17-JUN-16	
<b>Detailed Salinity in wet-weight mg/kg</b>							
Chloride (Cl)	114		0.84	mg/kg wwt		17-JUN-16	
Calcium (Ca)	85.2		4.2	mg/kg wwt		17-JUN-16	
Magnesium (Mg)	72.2		4.2	mg/kg wwt		17-JUN-16	
Potassium (K)	17.5		4.2	mg/kg wwt		17-JUN-16	
Sodium (Na)	97.8		4.2	mg/kg wwt		17-JUN-16	
Sulfur (as SO4)	27.7		4.2	mg/kg wwt		17-JUN-16	
<b>Metals</b>							
Aluminum (Al)	13300		500	mg/kg	13-JUN-16	14-JUN-16	R3479690
Antimony (Sb)	0.63		0.10	mg/kg	13-JUN-16	14-JUN-16	R3479690
Arsenic (As)	3.32		0.10	mg/kg	13-JUN-16	14-JUN-16	R3479690
Barium (Ba)	180		0.50	mg/kg	13-JUN-16	14-JUN-16	R3479690
Beryllium (Be)	0.59		0.10	mg/kg	13-JUN-16	14-JUN-16	R3479690
Bismuth (Bi)	2.06		0.020	mg/kg	13-JUN-16	14-JUN-16	R3479690
Boron (B)	25		10	mg/kg	13-JUN-16	14-JUN-16	R3479690
Cadmium (Cd)	0.711		0.020	mg/kg	13-JUN-16	14-JUN-16	R3479690
Calcium (Ca)	84100		100	mg/kg	13-JUN-16	14-JUN-16	R3479690
Chromium (Cr)	23.4		1.0	mg/kg	13-JUN-16	14-JUN-16	R3479690
Cobalt (Co)	6.46		0.020	mg/kg	13-JUN-16	14-JUN-16	R3479690
Copper (Cu)	253		1.0	mg/kg	13-JUN-16	14-JUN-16	R3479690
Iron (Fe)	18000		25	mg/kg	13-JUN-16	14-JUN-16	R3479690
Lead (Pb)	16.0		0.20	mg/kg	13-JUN-16	14-JUN-16	R3479690
Magnesium (Mg)	12300		10	mg/kg	13-JUN-16	14-JUN-16	R3479690
Manganese (Mn)	402		0.50	mg/kg	13-JUN-16	14-JUN-16	R3479690
Molybdenum (Mo)	4.15		0.020	mg/kg	13-JUN-16	14-JUN-16	R3479690

\* Refer to Referenced Information for Qualifiers (if any) and Methodology.

## ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1781394-2 SECONDARY							
Sampled By: JO/AN on 09-JUN-16 @ 13:15							
Matrix: Sludge							
<b>Metals</b>							
Nickel (Ni)	20.3		0.50	mg/kg	13-JUN-16	14-JUN-16	R3479690
Phosphorus (P)	2870		100	mg/kg	13-JUN-16	14-JUN-16	R3479690
Potassium (K)	2780		25	mg/kg	13-JUN-16	14-JUN-16	R3479690
Selenium (Se)	7.97		0.50	mg/kg	13-JUN-16	14-JUN-16	R3479690
Silver (Ag)	2.97		0.10	mg/kg	13-JUN-16	14-JUN-16	R3479690
Sodium (Na)	963		10	mg/kg	13-JUN-16	14-JUN-16	R3479690
Strontium (Sr)	233		0.10	mg/kg	13-JUN-16	14-JUN-16	R3479690
Thallium (Tl)	0.26		0.10	mg/kg	13-JUN-16	14-JUN-16	R3479690
Tin (Sn)	5.8		5.0	mg/kg	13-JUN-16	14-JUN-16	R3479690
Titanium (Ti)	93.6		0.50	mg/kg	13-JUN-16	14-JUN-16	R3479690
Uranium (U)	16.4		0.020	mg/kg	13-JUN-16	14-JUN-16	R3479690
Vanadium (V)	41.4		0.50	mg/kg	13-JUN-16	14-JUN-16	R3479690
Zinc (Zn)	165		10	mg/kg	13-JUN-16	14-JUN-16	R3479690
<b>Total Available N &amp; NO3-N, NO2-N &amp; NH4</b>							
<b>Available Ammonium-N</b>							
Available Ammonium-N	316	NSSM	40	mg/kg	16-JUN-16	16-JUN-16	R3482481
Note: Done as Rec'd, back calc to dry							
<b>Nitrate, Nitrite &amp; Nitrate+Nitrite-N(KCL</b>							
Nitrite-N	<4.0	NSSM	4.0	mg/kg	16-JUN-16	16-JUN-16	R3482594
Nitrate+Nitrite-N	<20	NSSM	20	mg/kg	16-JUN-16	16-JUN-16	R3482594
Nitrate-N	<20	NSSM	20	mg/kg	16-JUN-16	16-JUN-16	R3482594
Note: Done as Received, Back Calc to dry							
<b>Detailed Salinity -over sat'd waste</b>							
<b>SAR and Cations (over sat'd)</b>							
Calcium (Ca)	101		5.0	mg/L	16-JUN-16	16-JUN-16	R3481147
Potassium (K)	20.8		5.0	mg/L	16-JUN-16	16-JUN-16	R3481147
Magnesium (Mg)	86.0		5.0	mg/L	16-JUN-16	16-JUN-16	R3481147
Sodium (Na)	116		5.0	mg/L	16-JUN-16	16-JUN-16	R3481147
Sulfur (as SO4)	33.0		5.0	mg/L	16-JUN-16	16-JUN-16	R3481147
SAR	2.06		0.10	SAR	16-JUN-16	16-JUN-16	R3481147

\* Refer to Referenced Information for Qualifiers (if any) and Methodology.



## Reference Information

### Sample Parameter Qualifier Key:

Qualifier	Description
DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).
NSSM	Non-standard sample matrix. Modified methods were used for sample processing and analysis.
NSSM	Non-standard sample matrix. Modified methods were used for sample processing and analysis.

### Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
B-HOTW-SK	Soil	Available Boron, Hot Water	CSSS (2008) Ch.9
Hot water is used to extract the plant-available and potentially plant-available boron from soil. Boron in the extract is determined by ICP-OES.			
C-TOT-LECO-SK	Soil	Total Carbon by combustion method	SSSA (1996) P. 973-974
The sample is ignited in a combustion analyzer where carbon in the reduced CO <sub>2</sub> gas is determined using a thermal conductivity detector.			
CL-COL-SK	Waste	Chloride (Cl)	APHA 4110B
ETL-N-TOT-AVAIL-SK	Soil	Available Ammonium-N - Calculation	Soil Methods of Analysis (1993) CSSS
HG-200.2-CVAF-WP	Soil	Mercury in Soil by CVAFS	EPA 200.2/1631E (mod)
Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAFS.			
K-AVAIL-SK	Soil	Available Potassium	Comm. Soil Sci. Plant, 25 (5&6)
Plant available potassium is extracted from the soil using Modified Kelowna solution. Potassium in the soil extract is determined by flame emission at 770 nm.			
MET-200.2-MS-WP	Soil	Metals	EPA 200.2/6020A
Samples for analysis are homogenized, dried at 60 degrees Celsius, sieved through a 2 mm (10 mesh) sieve, and a representative subsample of the dry material is weighed. The sample is then digested by block digester (EPA 200.2). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).			
Method Limitation: This method is not a total digestion technique. It is a very strong acid digestion that is intended to dissolve those metals that may become "environmentally available." By design, elements bound in silicate structures are not normally dissolved by this procedure as they are not usually mobile in the environment.			
MOIST-SK	Soil	Moisture Content	ASTM D2216-80
The weighed portion of soil is placed in a 105°C oven overnight. The dried soil is allowed to cooled to room temperature, weighed and the % moisture is calculated.			
Reference: ASTM D2216-80			
N-TOTKJ-COL-SK	Soil	Total Kjeldahl Nitrogen	CSSS (2008) 22.2.3
The soil is digested with sulfuric acid in the presence of CuSO <sub>4</sub> and K <sub>2</sub> SO <sub>4</sub> catalysts. Ammonia in the soil extract is determined colrimetrically at 660 nm.			
N2/N3-AVAIL-KCL-SK	Soil	Nitrate, Nitrite & Nitrate+Nitrite-N(KCL)	CSSS (1993) p. 26-28
Plant available nitrate and nitrite are extracted from the sample with 2N KCl. Nitrate and Nitrite in the filtered extract are determined colorimetrically by Technicon auto-analyzer or flow injection analyzer at 520 nm.			
NH4-AVAIL-SK	Soil	Available Ammonium-N	CSSS(1993) 4.2/COMM SOIL SCI 19(6)
Ammonium (NH <sub>4</sub> -N) is extracted from the soil using 2 N KCl. Ammonium in the extract is mixed with hypochlorite and salicylate to form indophenol blue, which is determined colorimetrically by auto analysis at 660 nm.			
OM-LOI-SK	Soil	Organic Matter by LOI at 375 deg C.	CSSS (1978) p. 160
The dry-ash method involves the removal of organic matter by combustion at 375 degrees C for a minimum of 16 hours. Samples are dried prior to combustion.			
Reference: McKeague, J.A. Soil Sampling and Methods of Analysis. Can. Soc. Soil Sci.(1978) method 4.23			
PH,EC-1:2-SK	Soil	pH and EC (1:2 Soil:Water Extraction)	AB Ag (1988) p.7
1 part dry soil and 2 parts de-ionized water (by volume) is mixed. The slurry is allowed to stand with occasional stirring for 30 - 60 minutes. After equilibration, pH of the slurry is measured using a pH meter. Conductivity of the filtered extract is measured by a conductivity meter.			

## Reference Information

## Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
PH/EC-SK	Waste	pH and Conductivity	APHA 4500-H,2510
PO4-AVAIL-OLSEN-SK	Soil	Available Phosphate-P by Olsen	CSSS (1993) 7.2,7.3.1
Plant available phosphorus is extracted from the sample with sodium bicarbonate. PO4-P in the filtered extract is determined colorimetrically at 880 nm.			
SAL-D50-DRYCALC-SK	Waste	Detailed Salinity in dry-weight mg/kg	Calculation
Conversion of Saturation Extract soluble ions from units of mg/L to dry-weight mg/kg. For over-saturated wastes: mg/kg dwt = mg/L * % Moisture / (100% - % Moisture) For under-saturated wastes: mg/kg dwt = mg/L * (% Saturation / 100%)			
SAL-D50-WETCALC-SK	Waste	Detailed Salinity in wet-weight mg/kg	Calculation
Conversion of Saturation Extract soluble ions from units of mg/L to wet-weight mg/kg. For over-saturated wastes: mg/kg wwt = mg/L * % Moisture / 100% For under-saturated wastes: mg/kg wwt = mg/L * (% Saturation / 100%) * (100% - % Moisture) / 100%			
SALINITY-INTCHECK-SK	Soil		CSSS 18.4-Calculation
SAR-CALC-SK	Waste	SAR and Cations (over sat'd)	APHA 3120B
SAT-PCNT-SK	Soil	Saturated Paste	CSSS (1993) 18.2.2
SO4-AVAIL-SK	Soil	Available Sulfate-S	REC METH SOIL ANAL - AB. AG(1988)
Plant available sulfate in the soil is extracted using a weak calcium chloride solution. Sulfate in the extract is determined by ICP-OES. This extraction may also produce organic sulfur in the extracts when organic soils are analyzed.			
SOLIDS-TOT/TOTVOL-SK	Manure	Total Solids and Total Volatile Solids	APHA 2540G
A well-mixed sample is evaporated in a weighed dish and dried to constant weight in an oven at 103-105°C. The increase in weight over that of the empty dish represents the Total Solids. The crucible is then ignited at 550°–10°C for 1 hour. The remaining solids represent the Total Fixed Solids, while the weight lost on ignition represents the Total Volatile Solids.			
SPECGRAV-CL	Soil	Specific Gravity	ASTM D 5057 - 90
A portion of sample is weighed in a container that is calibrated for volume. Specific Gravity is reported as the mass of sample per mass of an equal volume of pure water, where the density of pure water is taken to be 1.00 g/mL.			

\*\* ALS test methods may incorporate modifications from specified reference methods to improve performance.

*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
SK	ALS ENVIRONMENTAL - SASKATOON, SASKATCHEWAN, CANADA
WP	ALS ENVIRONMENTAL - WINNIPEG, MANITOBA, CANADA
CL	ALS ENVIRONMENTAL - CALGARY, ALBERTA, CANADA

## Chain of Custody Numbers:

## Reference Information

### Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
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#### GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

mg/kg - milligrams per kilogram based on dry weight of sample

mg/kg wwt - milligrams per kilogram based on wet weight of sample

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight

mg/L - 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.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



## Quality Control Report

Workorder: L1781394

Report Date: 24-JUN-16

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Client: KGS Group Consultants (Winnipeg)  
 865 Waverly Street - 3rd Floor  
 Winnipeg MB R3T 5P4

Contact: Kenton Thiessen

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>B-HOTW-SK</b>								
	<b>Soil</b>							
<b>Batch</b>	<b>R3481132</b>							
<b>WG2327459-2</b>	<b>IRM</b>	<b>SAL814</b>						
Boron (B), Hot Water Ext.			89.3		%		70-130	16-JUN-16
<b>WG2327459-1</b>	<b>MB</b>							
Boron (B), Hot Water Ext.			<0.20		mg/kg		0.2	16-JUN-16
<b>C-TOT-LECO-SK</b>								
	<b>Soil</b>							
<b>Batch</b>	<b>R3480694</b>							
<b>WG2327376-1</b>	<b>DUP</b>	<b>L1781394-1</b>						
Total Carbon by Combustion		1.71	1.72		%	0.6	20	15-JUN-16
<b>WG2327376-2</b>	<b>IRM</b>	<b>08-109_SOIL</b>						
Total Carbon by Combustion			104.3		%		80-120	15-JUN-16
<b>WG2327376-3</b>	<b>MB</b>							
Total Carbon by Combustion			<0.05		%		0.05	15-JUN-16
<b>HG-200.2-CVAF-WP</b>								
	<b>Soil</b>							
<b>Batch</b>	<b>R3479523</b>							
<b>WG2327478-3</b>	<b>CRM</b>	<b>CANMET TILL-1</b>						
Mercury (Hg)			0.100		mg/kg		0.048-0.148	14-JUN-16
<b>WG2327478-4</b>	<b>CRM</b>	<b>PACS-3</b>						
Mercury (Hg)			102.7		%		70-130	14-JUN-16
<b>WG2327478-5</b>	<b>DUP</b>	<b>L1781394-1</b>						
Mercury (Hg)		0.337	0.321		mg/kg	4.8	40	14-JUN-16
<b>WG2327478-2</b>	<b>LCS</b>							
Mercury (Hg)			102.5		%		80-120	14-JUN-16
<b>WG2327478-1</b>	<b>MB</b>							
Mercury (Hg)			<0.050		mg/kg		0.05	14-JUN-16
<b>K-AVAIL-SK</b>								
	<b>Soil</b>							
<b>Batch</b>	<b>R3482495</b>							
<b>WG2327460-2</b>	<b>IRM</b>	<b>FARM2005</b>						
Available Potassium			90.0		%		70-130	16-JUN-16
<b>WG2327460-1</b>	<b>MB</b>							
Available Potassium			<20		mg/kg		20	16-JUN-16
<b>MET-200.2-MS-WP</b>								
	<b>Soil</b>							
<b>Batch</b>	<b>R3479690</b>							
<b>WG2327003-3</b>	<b>CRM</b>	<b>CANMET TILL-1</b>						
Aluminum (Al)			99.1		%		70-130	14-JUN-16
Antimony (Sb)			110.3		%		70-130	14-JUN-16
Arsenic (As)			108.1		%		70-130	14-JUN-16
Barium (Ba)			103.5		%		70-130	14-JUN-16

## Quality Control Report

Workorder: L1781394

Report Date: 24-JUN-16

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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>MET-200.2-MS-WP</b>	<b>Soil</b>							
<b>Batch</b>	<b>R3479690</b>							
<b>WG2327003-3</b>	<b>CRM</b>	<b>CANMET TILL-1</b>						
Beryllium (Be)			100.3		%		70-130	14-JUN-16
Bismuth (Bi)			111.4		%		70-130	14-JUN-16
Cadmium (Cd)			97.7		%		70-130	14-JUN-16
Calcium (Ca)			104.6		%		70-130	14-JUN-16
Chromium (Cr)			102.5		%		70-130	14-JUN-16
Cobalt (Co)			101.7		%		70-130	14-JUN-16
Copper (Cu)			99.6		%		70-130	14-JUN-16
Iron (Fe)			96.7		%		70-130	14-JUN-16
Lead (Pb)			103.1		%		70-130	14-JUN-16
Magnesium (Mg)			99.5		%		70-130	14-JUN-16
Manganese (Mn)			102.1		%		70-130	14-JUN-16
Molybdenum (Mo)			97.7		%		70-130	14-JUN-16
Nickel (Ni)			103.1		%		70-130	14-JUN-16
Phosphorus (P)			108.2		%		70-130	14-JUN-16
Potassium (K)			98.2		%		70-130	14-JUN-16
Selenium (Se)			115.2		%		70-130	14-JUN-16
Silver (Ag)			115.9		%		70-130	14-JUN-16
Sodium (Na)			96.7		%		70-130	14-JUN-16
Strontium (Sr)			104.9		%		70-130	14-JUN-16
Thallium (Tl)			0.15		mg/kg		0.03-0.23	14-JUN-16
Tin (Sn)			94.7		%		70-130	14-JUN-16
Titanium (Ti)			87.7		%		70-130	14-JUN-16
Uranium (U)			113.8		%		70-130	14-JUN-16
Vanadium (V)			105.6		%		70-130	14-JUN-16
Zinc (Zn)			99.9		%		70-130	14-JUN-16
<b>WG2327003-4</b>	<b>CRM</b>	<b>PACS-3</b>						
Aluminum (Al)			103.4		%		70-130	14-JUN-16
Antimony (Sb)			124.4		%		70-130	14-JUN-16
Arsenic (As)			103.1		%		70-130	14-JUN-16
Barium (Ba)			72.6		%		70-130	14-JUN-16
Beryllium (Be)			128.5		%		70-130	14-JUN-16
Boron (B)			120.1		%		70-130	14-JUN-16
Cadmium (Cd)			100.7		%		70-130	14-JUN-16
Calcium (Ca)			120.7		%		70-130	14-JUN-16

## Quality Control Report

Workorder: L1781394

Report Date: 24-JUN-16

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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>MET-200.2-MS-WP</b>								
	<b>Soil</b>							
<b>Batch</b>	<b>R3479690</b>							
<b>WG2327003-4</b>	<b>CRM</b>	<b>PACS-3</b>						
Chromium (Cr)			104.9		%		70-130	14-JUN-16
Cobalt (Co)			105.7		%		70-130	14-JUN-16
Copper (Cu)			106.0		%		70-130	14-JUN-16
Iron (Fe)			100.7		%		70-130	14-JUN-16
Lead (Pb)			114.0		%		70-130	14-JUN-16
Magnesium (Mg)			119.7		%		70-130	14-JUN-16
Manganese (Mn)			101.1		%		70-130	14-JUN-16
Molybdenum (Mo)			116.2		%		70-130	14-JUN-16
Nickel (Ni)			103.7		%		70-130	14-JUN-16
Phosphorus (P)			100.1		%		70-130	14-JUN-16
Potassium (K)			101.3		%		70-130	14-JUN-16
Selenium (Se)			1.07		mg/kg		0.51-1.51	14-JUN-16
Silver (Ag)			118.8		%		70-130	14-JUN-16
Sodium (Na)			107.0		%		70-130	14-JUN-16
Strontium (Sr)			106.8		%		70-130	14-JUN-16
Thallium (Tl)			0.34		mg/kg		0.23-0.43	14-JUN-16
Tin (Sn)			100.4		%		70-130	14-JUN-16
Titanium (Ti)			91.4		%		70-130	14-JUN-16
Uranium (U)			127.1		%		70-130	14-JUN-16
Vanadium (V)			107.5		%		70-130	14-JUN-16
Zinc (Zn)			103.1		%		70-130	14-JUN-16
<b>WG2327003-2</b>	<b>LCS</b>							
Aluminum (Al)			101.2		%		80-120	14-JUN-16
Antimony (Sb)			106.8		%		80-120	14-JUN-16
Arsenic (As)			104.5		%		80-120	14-JUN-16
Barium (Ba)			108.1		%		80-120	14-JUN-16
Beryllium (Be)			101.1		%		80-120	14-JUN-16
Bismuth (Bi)			103.1		%		80-120	14-JUN-16
Boron (B)			101.1		%		80-120	14-JUN-16
Cadmium (Cd)			103.0		%		80-120	14-JUN-16
Calcium (Ca)			107.7		%		80-120	14-JUN-16
Chromium (Cr)			105.7		%		80-120	14-JUN-16
Cobalt (Co)			105.0		%		80-120	14-JUN-16
Copper (Cu)			102.5		%		80-120	14-JUN-16

## Quality Control Report

Workorder: L1781394

Report Date: 24-JUN-16

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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>MET-200.2-MS-WP</b>	<b>Soil</b>							
<b>Batch</b>	<b>R3479690</b>							
<b>WG2327003-2</b>	<b>LCS</b>							
Iron (Fe)			101.5		%		80-120	14-JUN-16
Lead (Pb)			105.1		%		80-120	14-JUN-16
Magnesium (Mg)			110.9		%		80-120	14-JUN-16
Manganese (Mn)			105.0		%		80-120	14-JUN-16
Molybdenum (Mo)			106.8		%		80-120	14-JUN-16
Nickel (Ni)			103.7		%		80-120	14-JUN-16
Phosphorus (P)			119.8		%		80-120	14-JUN-16
Potassium (K)			106.4		%		80-120	14-JUN-16
Selenium (Se)			106.7		%		80-120	14-JUN-16
Silver (Ag)			108.7		%		80-120	14-JUN-16
Sodium (Na)			105.0		%		80-120	14-JUN-16
Strontium (Sr)			108.1		%		80-120	14-JUN-16
Thallium (Tl)			96.9		%		80-120	14-JUN-16
Tin (Sn)			103.6		%		80-120	14-JUN-16
Titanium (Ti)			103.3		%		80-120	14-JUN-16
Uranium (U)			107.7		%		80-120	14-JUN-16
Vanadium (V)			106.7		%		80-120	14-JUN-16
Zinc (Zn)			100.4		%		80-120	14-JUN-16
<b>WG2327003-1</b>	<b>MB</b>							
Aluminum (Al)			<5.0		mg/kg		5	14-JUN-16
Antimony (Sb)			<0.10		mg/kg		0.1	14-JUN-16
Arsenic (As)			<0.10		mg/kg		0.1	14-JUN-16
Barium (Ba)			<0.50		mg/kg		0.5	14-JUN-16
Beryllium (Be)			<0.10		mg/kg		0.1	14-JUN-16
Bismuth (Bi)			<0.020		mg/kg		0.02	14-JUN-16
Boron (B)			<10		mg/kg		10	14-JUN-16
Cadmium (Cd)			<0.020		mg/kg		0.02	14-JUN-16
Calcium (Ca)			<100		mg/kg		100	14-JUN-16
Chromium (Cr)			<1.0		mg/kg		1	14-JUN-16
Cobalt (Co)			<0.020		mg/kg		0.02	14-JUN-16
Copper (Cu)			<1.0		mg/kg		1	14-JUN-16
Iron (Fe)			<25		mg/kg		25	14-JUN-16
Lead (Pb)			<0.20		mg/kg		0.2	14-JUN-16
Magnesium (Mg)			<10		mg/kg		10	14-JUN-16





## Quality Control Report

Workorder: L1781394

Report Date: 24-JUN-16

Page 5 of 8

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>MET-200.2-MS-WP</b>								
	<b>Soil</b>							
<b>Batch</b>	<b>R3479690</b>							
<b>WG2327003-1</b>	<b>MB</b>							
Manganese (Mn)			<0.50		mg/kg		0.5	14-JUN-16
Molybdenum (Mo)			<0.020		mg/kg		0.02	14-JUN-16
Nickel (Ni)			<0.50		mg/kg		0.5	14-JUN-16
Phosphorus (P)			<100		mg/kg		100	14-JUN-16
Potassium (K)			<25		mg/kg		25	14-JUN-16
Selenium (Se)			<0.50		mg/kg		0.5	14-JUN-16
Silver (Ag)			<0.10		mg/kg		0.1	14-JUN-16
Sodium (Na)			<10		mg/kg		10	14-JUN-16
Strontium (Sr)			<0.10		mg/kg		0.1	14-JUN-16
Thallium (Tl)			<0.10		mg/kg		0.1	14-JUN-16
Tin (Sn)			<5.0		mg/kg		5	14-JUN-16
Titanium (Ti)			<0.50		mg/kg		0.5	14-JUN-16
Uranium (U)			<0.020		mg/kg		0.02	14-JUN-16
Vanadium (V)			<0.50		mg/kg		0.5	14-JUN-16
Zinc (Zn)			<10		mg/kg		10	14-JUN-16
<b>MOIST-SK</b>								
	<b>Soil</b>							
<b>Batch</b>	<b>R3479722</b>							
<b>WG2327270-1</b>	<b>DUP</b>	<b>L1781394-1</b>						
% Moisture		92.8	91.1		%	1.9	20	15-JUN-16
<b>N-TOTKJ-COL-SK</b>								
	<b>Soil</b>							
<b>Batch</b>	<b>R3486371</b>							
<b>WG2329725-2</b>	<b>IRM</b>	<b>08-109_SOIL</b>						
Total Kjeldahl Nitrogen			88.8		%		80-120	21-JUN-16
<b>WG2329725-3</b>	<b>MB</b>							
Total Kjeldahl Nitrogen			<0.020		%		0.02	21-JUN-16
<b>N2/N3-AVAIL-KCL-SK</b>								
	<b>Soil</b>							
<b>Batch</b>	<b>R3482594</b>							
<b>WG2327462-2</b>	<b>IRM</b>	<b>SAL814</b>						
Nitrate+Nitrite-N			95.8		%		70-130	16-JUN-16
<b>WG2327462-1</b>	<b>MB</b>							
Nitrite-N			<1.0		mg/kg		1	16-JUN-16
Nitrate+Nitrite-N			<2.0		mg/kg		2	16-JUN-16
<b>NH4-AVAIL-SK</b>								
	<b>Soil</b>							

## Quality Control Report

Workorder: L1781394

Report Date: 24-JUN-16

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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>NH4-AVAIL-SK</b> <b>Soil</b>								
Batch	R3482481							
<b>WG2327465-2</b>	<b>IRM</b>	<b>SAL814</b>						
Available Ammonium-N			77.4		%		70-130	16-JUN-16
<b>WG2327465-1</b>	<b>MB</b>							
Available Ammonium-N			<1.0		mg/kg		1	16-JUN-16
<b>OM-LOI-SK</b> <b>Soil</b>								
Batch	R3483086							
<b>WG2329956-3</b>	<b>IRM</b>	<b>SAL2001</b>						
Organic Matter			101.5		%		80-120	17-JUN-16
Loss on Ignition @ 375 C			101.3		%		80-120	17-JUN-16
<b>WG2329956-2</b>	<b>MB</b>							
Organic Matter			<1.0		%		1	17-JUN-16
Loss on Ignition @ 375 C			<1.0		%		1	17-JUN-16
<b>PH,EC-1:2-SK</b> <b>Soil</b>								
Batch	R3482586							
<b>WG2327470-2</b>	<b>IRM</b>	<b>SAL814</b>						
Conductivity (1:2)			82.2		%		80-120	17-JUN-16
pH (1:2 soil:water)			8.17		pH		7.65-8.25	17-JUN-16
<b>WG2327470-1</b>	<b>MB</b>							
Conductivity (1:2)			<0.050		dS m-1		0.05	17-JUN-16
<b>PO4-AVAIL-OLSEN-SK</b> <b>Soil</b>								
Batch	R3482378							
<b>WG2327477-2</b>	<b>IRM</b>	<b>FARM2005</b>						
Available Phosphate-P			95.7		%		70-130	16-JUN-16
<b>WG2327477-1</b>	<b>MB</b>							
Available Phosphate-P			<1.0		mg/kg		1	16-JUN-16
<b>SO4-AVAIL-SK</b> <b>Soil</b>								
Batch	R3482035							
<b>WG2327475-2</b>	<b>IRM</b>	<b>SAL814</b>						
Available Sulfate-S			97.3		%		70-130	16-JUN-16
<b>WG2327475-1</b>	<b>MB</b>							
Available Sulfate-S			<4.0		mg/kg		4	16-JUN-16
<b>SPECGRAV-CL</b> <b>Soil</b>								
Batch	R3483558							
<b>WG2330191-2</b>	<b>DUP</b>	<b>L1781394-1</b>						
Specific Gravity		1.04	1.05		kg/L	1.0	20	20-JUN-16
<b>WG2330191-1</b>	<b>IRM</b>	<b>DI_H2O</b>						
Specific Gravity			102.0		%		90-110	20-JUN-16



## Quality Control Report

Workorder: L1781394

Report Date: 24-JUN-16

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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>CL-COL-SK Waste</b>								
Batch	R3482533							
WG2328078-1 MB								
Chloride (Cl)			<1.0		mg/L		1	16-JUN-16
<b>PH/EC-SK Waste</b>								
Batch	R3480699							
WG2328078-1 MB								
Conductivity (EC)			<0.20		dS m-1		0.2	15-JUN-16
<b>SAR-CALC-SK Waste</b>								
Batch	R3481147							
WG2328078-1 MB								
Calcium (Ca)			<5.0		mg/L		5	16-JUN-16
Potassium (K)			<5.0		mg/L		5	16-JUN-16
Magnesium (Mg)			<5.0		mg/L		5	16-JUN-16
Sodium (Na)			<5.0		mg/L		5	16-JUN-16
Sulfur (as SO4)			<5.0		mg/L		5	16-JUN-16
<b>SOLIDS-TOT/TOTVOL-SK Manure</b>								
Batch	R3482763							
WG2327574-1 DUP		L1781394-1						
Total Solids		8.03	8.66		%	7.6	25	17-JUN-16
Total Volatile Solids (dry basis)		29.3	28.4		%	3.1	25	17-JUN-16

# Quality Control Report

Workorder: L1781394

Report Date: 24-JUN-16

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## Legend:

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Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

## Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

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The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.



L1781394-COFC

<b>Report To</b> Contact and company name below will appear on the final report Company: <b>KGS GROUP</b> Contact: <b>Kenton Thiessen</b> Phone: <b>204-596-1209</b> <small>Company address below will appear on the final report</small> Street: <b>3rd Floor - 865 Waverley Street</b> City/Province: <b>Winnipeg, MB</b> Postal Code: <b>R3T 5P4</b>		<b>Report Format / Distribution</b> Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input type="checkbox"/> EOD (DIGITAL) Quality Control (QC) Report with Report <input type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> Compare Results to Criteria on Report - provide details below if box checked Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX Email 1 or Fax: <b>kthiessen@kgsgroup.com</b> Email 2: <b>pnghuyen@kgsgroup.com</b> Email 3:		<small>R E&amp;P TATs with your AM - surcharges will apply</small> Regular [R] <input checked="" type="checkbox"/> Standard TAT if received by 3 pm - business days - no surcharges apply 4 day [P4] <input type="checkbox"/> 3 day [P3] <input type="checkbox"/> 2 day [P2] <input type="checkbox"/> EMERGENCY 1 Business day [E1] <input type="checkbox"/> Same Day, Weekend or Statutory holiday [E0] <input type="checkbox"/> Date and Time Required for all E&P TATs:																																														
<b>Invoice To</b> Same as Report To <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO Copy of Invoice with Report <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO Company: <b>KGS Group</b> Contact: <b>Bill MacQuarrie</b>		<b>Invoice Distribution</b> Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX Email 1 or Fax: <b>kthiessen@kgs.com</b> Email 2: <b>W Mac Quarrie @ KGS Group Ltd</b>		<b>Analysis Request</b> Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below																																														
<b>Project Information</b> ALS Account # / Quote #: <b>56403</b> Job #: <b>16-0429-004</b> PO / AFE: LSD:		<b>Oil and Gas Required Fields (client use)</b> AFE/Coast Center: PO# Major/Minor Code: Routing Code: Requisitioner: Location:		Analysis Request Table: <table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th>TXN</th> <th>Nitrate - N</th> <th>Nitrite - N</th> <th>Avail Ammonium - N</th> <th>Total Avail Nitrogen</th> <th>Total Phosphorous</th> <th>Total Solid, total volatile solids</th> <th>Moisture</th> <th>Total Carbon</th> <th>Avail. Potassium</th> <th>Avail. Sulfate</th> <th>Detailed Salinity</th> <th>Specific Gravity</th> <th>Metals</th> <th>Number of Containers</th> </tr> </thead> <tbody> <tr> <td></td> <td>X</td> <td>X</td> <td>X</td> <td>X</td> <td>X</td> <td>X</td> <td>X</td> <td>X</td> <td>X</td> <td>X</td> <td>X</td> <td>X</td> <td>X</td> <td>66</td> </tr> <tr> <td></td> <td>X</td> <td>X</td> <td>X</td> <td>X</td> <td>X</td> <td>X</td> <td>X</td> <td>X</td> <td>X</td> <td>X</td> <td>X</td> <td>X</td> <td>X</td> <td>66</td> </tr> </tbody> </table>		TXN	Nitrate - N	Nitrite - N	Avail Ammonium - N	Total Avail Nitrogen	Total Phosphorous	Total Solid, total volatile solids	Moisture	Total Carbon	Avail. Potassium	Avail. Sulfate	Detailed Salinity	Specific Gravity	Metals	Number of Containers		X	X	X	X	X	X	X	X	X	X	X	X	X	66		X	X	X	X	X	X	X	X	X	X	X	X	X	66
TXN	Nitrate - N	Nitrite - N	Avail Ammonium - N	Total Avail Nitrogen	Total Phosphorous	Total Solid, total volatile solids	Moisture	Total Carbon	Avail. Potassium	Avail. Sulfate	Detailed Salinity	Specific Gravity	Metals	Number of Containers																																				
	X	X	X	X	X	X	X	X	X	X	X	X	X	66																																				
	X	X	X	X	X	X	X	X	X	X	X	X	X	66																																				
<b>ALS Lab Work Order # (lab use only)</b>		<b>ALS Contact:</b>		<b>Sampler:</b> <b>Jocanna/A. Nuff</b>																																														
<b>ALS Sample # (lab use only)</b>		<b>Sample Identification and/or Coordinates (This description will appear on the report)</b>		<b>Date (dd-mm-yy)</b>		<b>Time (hh:mm)</b>		<b>Sample Type</b>																																										
		Primary		09-06-16		12:30		Sludge																																										
		Secondary		09-06-16		13:15		Sludge																																										

<b>Drinking Water (DW) Samples<sup>1</sup> (client use)</b> Are samples taken from a Regulated DW System? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO Are samples for human drinking water use? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO		<b>Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)</b> <p style="font-size: 2em; text-align: center;">Lagoon Sludge</p>		<b>SAMPLE CONDITION AS RECEIVED (lab use only)</b> Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/> Ice Packs <input type="checkbox"/> Ice Cubes <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/> Cooling Initiated <input type="checkbox"/> INITIAL COOLER TEMPERATURES °C: <span style="font-size: 1.5em;">14.4°C</span> FINAL COOLER TEMPERATURES °C:	
<b>SHIPMENT RELEASE (client use)</b> Released by: <b>Jocanna</b> Date: <b>June 10, 2016</b> Time: <b>1075</b>		<b>INITIAL SHIPMENT RECEPTION (lab use only)</b> Received by: <b>[Signature]</b> Date: <b>10/06/16</b> Time: <b>10:50am</b>		<b>FINAL SHIPMENT RECEPTION (lab use only)</b> Received by: Date: Time:	

**ATTACHMENT 3**



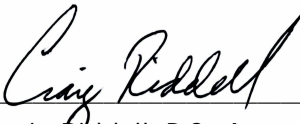
Tone Ag Consulting (St. Pierre-Jolys)  
ATTN: Shannon Wiebe  
31022 Rat River Rd  
St. Pierre-Jolys Manitoba ROA 1V0

Date Received: 29-SEP-16  
Report Date: 11-OCT-16 09:38 (MT)  
Version: FINAL REV. 2

Client Phone: 204-433-7189

## Certificate of Analysis

Lab Work Order #: L1836271  
Project P.O. #: NOT SUBMITTED  
Job Reference: PT 1/2-36-3-27W  
C of C Numbers:  
Legal Site Desc:

  
\_\_\_\_\_  
Craig Riddell, B.Sc.Ag  
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 1329 Niakwa Road East, Unit 12, Winnipeg, MB R2J 3T4 Canada | Phone: +1 204 255 9720 | Fax: +1 204 255 9721  
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company



## ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1836271-1 1437293 - FIELD #1 Sampled By: CLIENT on 27-SEP-16 Matrix: SOIL							
<b>Miscellaneous Parameters</b>							
Mercury (Hg)	0.0214		0.0050	mg/kg	03-OCT-16	04-OCT-16	R3563579
<b>Metals in Soil by CRC ICPMS</b>							
Aluminum (Al)	12100		50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Antimony (Sb)	0.20		0.10	mg/kg	03-OCT-16	03-OCT-16	R3562810
Arsenic (As)	4.10		0.10	mg/kg	03-OCT-16	03-OCT-16	R3562810
Barium (Ba)	147		0.50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Beryllium (Be)	0.48		0.10	mg/kg	03-OCT-16	03-OCT-16	R3562810
Boron (B)	12.3		5.0	mg/kg	03-OCT-16	03-OCT-16	R3562810
Bismuth (Bi)	<0.20		0.20	mg/kg	03-OCT-16	03-OCT-16	R3562810
Cadmium (Cd)	0.275		0.020	mg/kg	03-OCT-16	03-OCT-16	R3562810
Calcium (Ca)	26600		50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Chromium (Cr)	21.5		0.50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Cobalt (Co)	5.86		0.10	mg/kg	03-OCT-16	03-OCT-16	R3562810
Copper (Cu)	11.5		0.50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Iron (Fe)	15500		50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Lead (Pb)	6.14		0.50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Lithium (Li)	9.9		2.0	mg/kg	03-OCT-16	03-OCT-16	R3562810
Magnesium (Mg)	9980		20	mg/kg	03-OCT-16	03-OCT-16	R3562810
Manganese (Mn)	578		1.0	mg/kg	03-OCT-16	03-OCT-16	R3562810
Molybdenum (Mo)	0.19		0.10	mg/kg	03-OCT-16	03-OCT-16	R3562810
Nickel (Ni)	17.2		0.50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Phosphorus (P)	412		50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Potassium (K)	1940		100	mg/kg	03-OCT-16	03-OCT-16	R3562810
Selenium (Se)	<0.20		0.20	mg/kg	03-OCT-16	03-OCT-16	R3562810
Silver (Ag)	<0.10		0.10	mg/kg	03-OCT-16	03-OCT-16	R3562810
Sodium (Na)	192		50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Strontium (Sr)	50.2		0.50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Thallium (Tl)	0.204		0.050	mg/kg	03-OCT-16	03-OCT-16	R3562810
Tin (Sn)	<1.0		1.0	mg/kg	03-OCT-16	03-OCT-16	R3562810
Titanium (Ti)	137		1.0	mg/kg	03-OCT-16	03-OCT-16	R3562810
Uranium (U)	0.784		0.050	mg/kg	03-OCT-16	03-OCT-16	R3562810
Vanadium (V)	40.3		0.20	mg/kg	03-OCT-16	03-OCT-16	R3562810
Zinc (Zn)	48.5		2.0	mg/kg	03-OCT-16	03-OCT-16	R3562810
Zirconium (Zr)	3.0		1.0	mg/kg	03-OCT-16	03-OCT-16	R3562810
<b>Available N,P,K &amp; S plus pH, EC(AG) &amp; B</b>							
<b>Available Boron, Hot Water</b>							
Boron (B), Hot Water Ext.	1.20		0.20	mg/kg	03-OCT-16	03-OCT-16	R3563273
<b>Available Nitrate-N</b>							
Available Nitrate-N	2.7		1.0	mg/kg	04-OCT-16	04-OCT-16	R3563810
<b>Available Phosphate-P by Olsen</b>							
Available Phosphate-P	20.3		1.0	mg/kg	04-OCT-16	04-OCT-16	R3564786
<b>Available Potassium</b>							
Available Potassium	268		20	mg/kg	04-OCT-16	04-OCT-16	R3564737
<b>Available Sulfate-S</b>							
Available Sulfate-S	22.7		4.0	mg/kg	04-OCT-16	04-OCT-16	R3564368
<b>pH &amp; EC 1:2 soil to water (Ag. Method)</b>							
pH (1:2 soil:water)	7.68		0.10	pH	03-OCT-16	03-OCT-16	R3562690
Conductivity (1:2)	0.353		0.050	dS m-1	03-OCT-16	03-OCT-16	R3562690
L1836271-2 1437294 - FIELD #2 Sampled By: CLIENT on 27-SEP-16 Matrix: SOIL							

\* Refer to Referenced Information for Qualifiers (if any) and Methodology.

## ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1836271-2 1437294 - FIELD #2 Sampled By: CLIENT on 27-SEP-16 Matrix: SOIL							
<b>Miscellaneous Parameters</b>							
Mercury (Hg)	0.0357		0.0050	mg/kg	03-OCT-16	04-OCT-16	R3563579
<b>Metals in Soil by CRC ICPMS</b>							
Aluminum (Al)	17600		50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Antimony (Sb)	0.26		0.10	mg/kg	03-OCT-16	03-OCT-16	R3562810
Arsenic (As)	6.70		0.10	mg/kg	03-OCT-16	03-OCT-16	R3562810
Barium (Ba)	216		0.50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Beryllium (Be)	0.74		0.10	mg/kg	03-OCT-16	03-OCT-16	R3562810
Boron (B)	14.1		5.0	mg/kg	03-OCT-16	03-OCT-16	R3562810
Bismuth (Bi)	<0.20		0.20	mg/kg	03-OCT-16	03-OCT-16	R3562810
Cadmium (Cd)	0.411		0.020	mg/kg	03-OCT-16	03-OCT-16	R3562810
Calcium (Ca)	16000		50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Chromium (Cr)	32.1		0.50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Cobalt (Co)	9.93		0.10	mg/kg	03-OCT-16	03-OCT-16	R3562810
Copper (Cu)	20.2		0.50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Iron (Fe)	24600		50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Lead (Pb)	9.71		0.50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Lithium (Li)	13.8		2.0	mg/kg	03-OCT-16	03-OCT-16	R3562810
Magnesium (Mg)	11200		20	mg/kg	03-OCT-16	03-OCT-16	R3562810
Manganese (Mn)	807		1.0	mg/kg	03-OCT-16	03-OCT-16	R3562810
Molybdenum (Mo)	0.28		0.10	mg/kg	03-OCT-16	03-OCT-16	R3562810
Nickel (Ni)	27.5		0.50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Phosphorus (P)	609		50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Potassium (K)	2860		100	mg/kg	03-OCT-16	03-OCT-16	R3562810
Selenium (Se)	0.24		0.20	mg/kg	03-OCT-16	03-OCT-16	R3562810
Silver (Ag)	<0.10		0.10	mg/kg	03-OCT-16	03-OCT-16	R3562810
Sodium (Na)	269		50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Strontium (Sr)	35.7		0.50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Thallium (Tl)	0.295		0.050	mg/kg	03-OCT-16	03-OCT-16	R3562810
Tin (Sn)	<1.0		1.0	mg/kg	03-OCT-16	03-OCT-16	R3562810
Titanium (Ti)	91.3		1.0	mg/kg	03-OCT-16	03-OCT-16	R3562810
Uranium (U)	0.906		0.050	mg/kg	03-OCT-16	03-OCT-16	R3562810
Vanadium (V)	58.9		0.20	mg/kg	03-OCT-16	03-OCT-16	R3562810
Zinc (Zn)	82.0		2.0	mg/kg	03-OCT-16	03-OCT-16	R3562810
Zirconium (Zr)	4.6		1.0	mg/kg	03-OCT-16	03-OCT-16	R3562810
<b>Available N,P,K &amp; S plus pH, EC(AG) &amp; B</b>							
<b>Available Boron, Hot Water</b>							
Boron (B), Hot Water Ext.	1.31		0.20	mg/kg	03-OCT-16	03-OCT-16	R3563273
<b>Available Nitrate-N</b>							
Available Nitrate-N	2.7		1.0	mg/kg	04-OCT-16	04-OCT-16	R3563810
<b>Available Phosphate-P by Olsen</b>							
Available Phosphate-P	7.3		1.0	mg/kg	04-OCT-16	04-OCT-16	R3564786
<b>Available Potassium</b>							
Available Potassium	328		20	mg/kg	04-OCT-16	04-OCT-16	R3564737
<b>Available Sulfate-S</b>							
Available Sulfate-S	23.9		4.0	mg/kg	04-OCT-16	04-OCT-16	R3564368
<b>pH &amp; EC 1:2 soil to water (Ag. Method)</b>							
pH (1:2 soil:water)	8.04		0.10	pH	03-OCT-16	03-OCT-16	R3562690
Conductivity (1:2)	0.323		0.050	dS m-1	03-OCT-16	03-OCT-16	R3562690
L1836271-3 1437295 - FIELD #3 Sampled By: CLIENT on 27-SEP-16 Matrix: SOIL							

\* Refer to Referenced Information for Qualifiers (if any) and Methodology.

## ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1836271-3 1437295 - FIELD #3 Sampled By: CLIENT on 27-SEP-16 Matrix: SOIL							
<b>Miscellaneous Parameters</b>							
Mercury (Hg)	0.0312		0.0050	mg/kg	03-OCT-16	04-OCT-16	R3563579
<b>Metals in Soil by CRC ICPMS</b>							
Aluminum (Al)	9990		50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Antimony (Sb)	0.31		0.10	mg/kg	03-OCT-16	03-OCT-16	R3562810
Arsenic (As)	6.19		0.10	mg/kg	03-OCT-16	03-OCT-16	R3562810
Barium (Ba)	114		0.50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Beryllium (Be)	0.44		0.10	mg/kg	03-OCT-16	03-OCT-16	R3562810
Boron (B)	11.0		5.0	mg/kg	03-OCT-16	03-OCT-16	R3562810
Bismuth (Bi)	<0.20		0.20	mg/kg	03-OCT-16	03-OCT-16	R3562810
Cadmium (Cd)	0.289		0.020	mg/kg	03-OCT-16	03-OCT-16	R3562810
Calcium (Ca)	40900		50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Chromium (Cr)	24.0		0.50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Cobalt (Co)	5.97		0.10	mg/kg	03-OCT-16	03-OCT-16	R3562810
Copper (Cu)	11.1		0.50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Iron (Fe)	13800		50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Lead (Pb)	5.70		0.50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Lithium (Li)	9.8		2.0	mg/kg	03-OCT-16	03-OCT-16	R3562810
Magnesium (Mg)	11400		20	mg/kg	03-OCT-16	03-OCT-16	R3562810
Manganese (Mn)	633		1.0	mg/kg	03-OCT-16	03-OCT-16	R3562810
Molybdenum (Mo)	0.65		0.10	mg/kg	03-OCT-16	03-OCT-16	R3562810
Nickel (Ni)	20.6		0.50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Phosphorus (P)	397		50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Potassium (K)	1790		100	mg/kg	03-OCT-16	03-OCT-16	R3562810
Selenium (Se)	0.21		0.20	mg/kg	03-OCT-16	03-OCT-16	R3562810
Silver (Ag)	<0.10		0.10	mg/kg	03-OCT-16	03-OCT-16	R3562810
Sodium (Na)	201		50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Strontium (Sr)	44.7		0.50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Thallium (Tl)	0.232		0.050	mg/kg	03-OCT-16	03-OCT-16	R3562810
Tin (Sn)	<1.0		1.0	mg/kg	03-OCT-16	03-OCT-16	R3562810
Titanium (Ti)	168		1.0	mg/kg	03-OCT-16	03-OCT-16	R3562810
Uranium (U)	0.882		0.050	mg/kg	03-OCT-16	03-OCT-16	R3562810
Vanadium (V)	40.9		0.20	mg/kg	03-OCT-16	03-OCT-16	R3562810
Zinc (Zn)	41.0		2.0	mg/kg	03-OCT-16	03-OCT-16	R3562810
Zirconium (Zr)	2.8		1.0	mg/kg	03-OCT-16	03-OCT-16	R3562810
<b>Available N,P,K &amp; S plus pH, EC(AG) &amp; B</b>							
<b>Available Boron, Hot Water</b>							
Boron (B), Hot Water Ext.	1.24		0.20	mg/kg	03-OCT-16	03-OCT-16	R3563273
<b>Available Nitrate-N</b>							
Available Nitrate-N	2.7		1.0	mg/kg	04-OCT-16	04-OCT-16	R3563810
<b>Available Phosphate-P by Olsen</b>							
Available Phosphate-P	5.1		1.0	mg/kg	04-OCT-16	04-OCT-16	R3564786
<b>Available Potassium</b>							
Available Potassium	293		20	mg/kg	04-OCT-16	04-OCT-16	R3564737
<b>Available Sulfate-S</b>							
Available Sulfate-S	57.9		4.0	mg/kg	04-OCT-16	04-OCT-16	R3564368
<b>pH &amp; EC 1:2 soil to water (Ag. Method)</b>							
pH (1:2 soil:water)	7.88		0.10	pH	03-OCT-16	03-OCT-16	R3562690
Conductivity (1:2)	0.290		0.050	dS m-1	03-OCT-16	03-OCT-16	R3562690
L1836271-4 1437296 - FIELD #4 Sampled By: CLIENT on 27-SEP-16 Matrix: SOIL							

\* Refer to Referenced Information for Qualifiers (if any) and Methodology.

## ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1836271-4 1437296 - FIELD #4							
Sampled By: CLIENT on 27-SEP-16							
Matrix: SOIL							
<b>Miscellaneous Parameters</b>							
Mercury (Hg)	0.0196		0.0050	mg/kg	03-OCT-16	04-OCT-16	R3563579
<b>Metals in Soil by CRC ICPMS</b>							
Aluminum (Al)	7640		50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Antimony (Sb)	0.17		0.10	mg/kg	03-OCT-16	03-OCT-16	R3562810
Arsenic (As)	3.91		0.10	mg/kg	03-OCT-16	03-OCT-16	R3562810
Barium (Ba)	89.0		0.50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Beryllium (Be)	0.33		0.10	mg/kg	03-OCT-16	03-OCT-16	R3562810
Boron (B)	7.6		5.0	mg/kg	03-OCT-16	03-OCT-16	R3562810
Bismuth (Bi)	<0.20		0.20	mg/kg	03-OCT-16	03-OCT-16	R3562810
Cadmium (Cd)	0.224		0.020	mg/kg	03-OCT-16	03-OCT-16	R3562810
Calcium (Ca)	25000		50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Chromium (Cr)	17.1		0.50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Cobalt (Co)	5.29		0.10	mg/kg	03-OCT-16	03-OCT-16	R3562810
Copper (Cu)	7.82		0.50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Iron (Fe)	11400		50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Lead (Pb)	4.69		0.50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Lithium (Li)	6.3		2.0	mg/kg	03-OCT-16	03-OCT-16	R3562810
Magnesium (Mg)	7010		20	mg/kg	03-OCT-16	03-OCT-16	R3562810
Manganese (Mn)	405		1.0	mg/kg	03-OCT-16	03-OCT-16	R3562810
Molybdenum (Mo)	0.30		0.10	mg/kg	03-OCT-16	03-OCT-16	R3562810
Nickel (Ni)	15.3		0.50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Phosphorus (P)	341		50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Potassium (K)	1600		100	mg/kg	03-OCT-16	03-OCT-16	R3562810
Selenium (Se)	<0.20		0.20	mg/kg	03-OCT-16	03-OCT-16	R3562810
Silver (Ag)	<0.10		0.10	mg/kg	03-OCT-16	03-OCT-16	R3562810
Sodium (Na)	104		50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Strontium (Sr)	26.9		0.50	mg/kg	03-OCT-16	03-OCT-16	R3562810
Thallium (Tl)	0.151		0.050	mg/kg	03-OCT-16	03-OCT-16	R3562810
Tin (Sn)	<1.0		1.0	mg/kg	03-OCT-16	03-OCT-16	R3562810
Titanium (Ti)	148		1.0	mg/kg	03-OCT-16	03-OCT-16	R3562810
Uranium (U)	0.542		0.050	mg/kg	03-OCT-16	03-OCT-16	R3562810
Vanadium (V)	28.6		0.20	mg/kg	03-OCT-16	03-OCT-16	R3562810
Zinc (Zn)	36.6		2.0	mg/kg	03-OCT-16	03-OCT-16	R3562810
Zirconium (Zr)	1.9		1.0	mg/kg	03-OCT-16	03-OCT-16	R3562810
<b>Available N,P,K &amp; S plus pH, EC(AG) &amp; B</b>							
<b>Available Boron, Hot Water</b>							
Boron (B), Hot Water Ext.	1.07		0.20	mg/kg	03-OCT-16	03-OCT-16	R3563273
<b>Available Nitrate-N</b>							
Available Nitrate-N	2.9		1.0	mg/kg	04-OCT-16	04-OCT-16	R3563810
<b>Available Phosphate-P by Olsen</b>							
Available Phosphate-P	10.2		1.0	mg/kg	04-OCT-16	04-OCT-16	R3564786
<b>Available Potassium</b>							
Available Potassium	315		20	mg/kg	04-OCT-16	04-OCT-16	R3564737
<b>Available Sulfate-S</b>							
Available Sulfate-S	49.8		4.0	mg/kg	04-OCT-16	04-OCT-16	R3564368
<b>pH &amp; EC 1:2 soil to water (Ag. Method)</b>							
pH (1:2 soil:water)	7.80		0.10	pH	03-OCT-16	03-OCT-16	R3562690
Conductivity (1:2)	0.300		0.050	dS m-1	03-OCT-16	03-OCT-16	R3562690

\* Refer to Referenced Information for Qualifiers (if any) and Methodology.

## Reference Information

### Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
B-HOTW-SK	Soil	Available Boron, Hot Water	CSSS (2008) Ch.9
Hot water is used to extract the plant-available and potentially plant-available boron from soil. Boron in the extract is determined by ICP-OES.			
HG-200.2-CVAF-SK	Soil	Mercury in Soil by CVAFS	EPA 200.2/1631E (mod)
Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAFS.			
K-AVAIL-SK	Soil	Available Potassium	Comm. Soil Sci. Plant, 25 (5&6)
Plant available potassium is extracted from the soil using Modified Kelowna solution. Potassium in the soil extract is determined by flame emission at 770 nm.			
MET-200.2-CCMS-SK	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020A (mod)
Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CRC ICPMS.			
Method Limitation: This method is not a total digestion technique. It is a very strong acid digestion that is intended to dissolve those metals that may be environmentally available. This method does not dissolve all silicate materials and may result in a partial extraction. depending on the sample matrix, for some metals, including, but not limited to Al, Ba, Be, Cr, Sr, Ti, Tl, and V.			
NO3-AVAIL-SK	Soil	Available Nitrate-N	Method = Alberta Ag (1988)
Available Nitrate and Nitrite are extracted from the soil using a dilute calcium chloride solution. Nitrate is quantitatively reduced to nitrite by passage of the sample through a copperized cadmium column. The nitrite (reduced nitrate plus original nitrite) is then determined by diazotizing with sulfanilamide followed by coupling with N-(1-naphthyl) ethylenediamine dihydrochloride. The resulting water soluble dye has a magenta color which is measured at colorimetrically at 520nm.			
Reference: Recommended Methods of Soil Analysis for Canadian Prairie Agricultural Soils. Alberta Agriculture (1988) p. 19 and 28			
PH,EC-AG-SK	Soil	pH & EC 1:2 soil to water (Ag. Method)	CSSS 16.3,18.3.1 - 1:2 water extract
PO4-AVAIL-OLSEN-SK	Soil	Available Phosphate-P by Olsen	CSSS (1993) 7.2,7.3.1
Plant available phosphorus is extracted from the sample with sodium bicarbonate. PO4-P in the filtered extract is determined colorimetrically at 880 nm.			
SO4-AVAIL-SK	Soil	Available Sulfate-S	REC METH SOIL ANAL - AB. AG(1988)
Plant available sulfate in the soil is extracted using a weak calcium chloride solution. Sulfate in the extract is determined by ICP-OES. This extraction may also produce organic sulfur in the extracts when organic soils are analyzed.			

\*\* ALS test methods may incorporate modifications from specified reference methods to improve performance.

*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
SK	ALS ENVIRONMENTAL - SASKATOON, SASKATCHEWAN, CANADA

### Chain of Custody Numbers:

### GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

mg/kg - milligrams per kilogram based on dry weight of sample

mg/kg wwt - milligrams per kilogram based on wet weight of sample

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight

mg/L - 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.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



# Soil Test

**ALS Quote #** Q56352

**BILL TO:**  
 PHONE (204) 433-7189  
 DEALER CODE: \_\_\_\_\_ FAX (204) 433-3335  
 NAME: Tone Ag Consulting Ltd  
 ADDRESS: Box 333  
 TOWN: St. Pierre PROV: MB POSTAL CODE: R0A1W0  
 EMAIL: rontone@toneag.com

**MAIL RESULTS TO:** (Check ONE Box Only) L1836271

1.  SAME AS "BILL TO" ADDRESS 2.  SAME AS "BILL TO", BUT IDENTIFY CUSTOMER NAME ON REPORT AS: melita

3.  NAME AND ADDRESS BELOW

**Barcode:**

L1836271-COFC

DATE RECEIVED: 29.9.16 12:30PM

SAMPLE IDENTIFICATION NUMBER	SAMPLE IDENTIFICATION NUMBER	SAMPLE IDENTIFICATION NUMBER	SAMPLE IDENTIFICATION NUMBER
1437293	1437294	1437295	1437296

**FIELD INFORMATION:**

Date Sampled: Sep 27/16

Field Name: Field #1 Acres: 134

Legal Location MUST be completed:  
P1E1/2 3b 3 27  or E \_\_\_\_\_  
 Qtr Sec Twp Range Meridian R.M.

GPS: \_\_\_\_\_

**FIELD INFORMATION:**

Date Sampled: Sep 27/16

Field Name: Field #2 Acres: 98

Legal Location MUST be completed:  
NW 25 3 27  or E \_\_\_\_\_  
 Qtr Sec Twp Range Meridian R.M.

GPS: \_\_\_\_\_

**FIELD INFORMATION:**

Date Sampled: Sep 27/16

Field Name: Field #3 Acres: 220

Legal Location MUST be completed:  
NW 26 3 27  or E \_\_\_\_\_  
 Qtr Sec Twp Range Meridian R.M.

GPS: \_\_\_\_\_

**FIELD INFORMATION:**

Date Sampled: Sep 27/16

Field Name: Field #4 Acres: 163

Legal Location MUST be completed:  
SW 26 3 27  or E \_\_\_\_\_  
 Qtr Sec Twp Range Meridian R.M.

GPS: \_\_\_\_\_

**CROP TO BE SEEDED ON:** (Check ONE Box)

Fallow  Chemical Fallow  Established Forage

Legume/Pulse  Cereal, Oilseed or Other Crop Stubble

(if not fallow)  
 Last Crop: \_\_\_\_\_ Yield: \_\_\_\_\_

**CROP TO BE SEEDED ON:** (Check ONE Box)

Fallow  Chemical Fallow  Established Forage

Legume/Pulse  Cereal, Oilseed or Other Crop Stubble

(if not fallow)  
 Last Crop: \_\_\_\_\_ Yield: \_\_\_\_\_

**CROP TO BE SEEDED ON:** (Check ONE Box)

Fallow  Chemical Fallow  Established Forage

Legume/Pulse  Cereal, Oilseed or Other Crop Stubble

(if not fallow)  
 Last Crop: \_\_\_\_\_ Yield: \_\_\_\_\_

**CROP TO BE SEEDED ON:** (Check ONE Box)

Fallow  Chemical Fallow  Established Forage

Legume/Pulse  Cereal, Oilseed or Other Crop Stubble

(if not fallow)  
 Last Crop: \_\_\_\_\_ Yield: \_\_\_\_\_

**ROTATION:**

Continuous Cropping (3rd Consecutive Year)  
 Crop/Fallow, or Crop/Crop/Fallow

**STUBBLE MANAGEMENT:**

Baled  Spread  
 Other: \_\_\_\_\_

**ROTATION:**

Continuous Cropping (3rd Consecutive Year)  
 Crop/Fallow, or Crop/Crop/Fallow

**STUBBLE MANAGEMENT:**

Baled  Spread  
 Other: \_\_\_\_\_

**ROTATION:**

Continuous Cropping (3rd Consecutive Year)  
 Crop/Fallow, or Crop/Crop/Fallow

**STUBBLE MANAGEMENT:**

Baled  Spread  
 Other: \_\_\_\_\_

**ROTATION:**

Continuous Cropping (3rd Consecutive Year)  
 Crop/Fallow, or Crop/Crop/Fallow

**STUBBLE MANAGEMENT:**

Baled  Spread  
 Other: \_\_\_\_\_

**SAMPLING DEPTH:** (Check ONE Box)

0-12"  0-6, 0-24"  
 0-6, 6-12"  0-12, 0-24"  
 0-6, 6-12, 12-24"  ODD DEPTH  
 0-6, 6-24" 0- \_\_\_\_\_ OR 0-6, \_\_\_\_\_  
 0-12, 12-24" 6- \_\_\_\_\_  
 0-6" (Double Depths must include a 0-6" sample; Triple Odd Depths are not allowed).

**SAMPLING DEPTH:** (Check ONE Box)

0-12"  0-6, 0-24"  
 0-6, 6-12"  0-12, 0-24"  
 0-6, 6-12, 12-24"  ODD DEPTH  
 0-6, 6-24" 0- \_\_\_\_\_ OR 0-6, \_\_\_\_\_  
 0-12, 12-24" 6- \_\_\_\_\_  
 0-6" (Double Depths must include a 0-6" sample; Triple Odd Depths are not allowed).

**SAMPLING DEPTH:** (Check ONE Box)

0-12"  0-6, 0-24"  
 0-6, 6-12"  0-12, 0-24"  
 0-6, 6-12, 12-24"  ODD DEPTH  
 0-6, 6-24" 0- \_\_\_\_\_ OR 0-6, \_\_\_\_\_  
 0-12, 12-24" 6- \_\_\_\_\_  
 0-6" (Double Depths must include a 0-6" sample; Triple Odd Depths are not allowed).

**SAMPLING DEPTH:** (Check ONE Box)

0-12"  0-6, 0-24"  
 0-6, 6-12"  0-12, 0-24"  
 0-6, 6-12, 12-24"  ODD DEPTH  
 0-6, 6-24" 0- \_\_\_\_\_ OR 0-6, \_\_\_\_\_  
 0-12, 12-24" 6- \_\_\_\_\_  
 0-6" (Double Depths must include a 0-6" sample; Triple Odd Depths are not allowed).

Check if crop is:  Irrigated  Spring Sampling Only:  
 Depth of Moist Soil = \_\_\_\_\_ in.

Check if crop is:  Irrigated  Spring Sampling Only:  
 Depth of Moist Soil = \_\_\_\_\_ in.

Check if crop is:  Irrigated  Spring Sampling Only:  
 Depth of Moist Soil = \_\_\_\_\_ in.

Check if crop is:  Irrigated  Spring Sampling Only:  
 Depth of Moist Soil = \_\_\_\_\_ in.

**CROP OPTIONS:** Yield/Protein Goal

Crop \_\_\_\_\_ / \_\_\_\_\_

1. \_\_\_\_\_ / \_\_\_\_\_

2. \_\_\_\_\_ / \_\_\_\_\_

**CROP OPTIONS:** Yield/Protein Goal

Crop \_\_\_\_\_ / \_\_\_\_\_

1. \_\_\_\_\_ / \_\_\_\_\_

2. \_\_\_\_\_ / \_\_\_\_\_

**CROP OPTIONS:** Yield/Protein Goal

Crop \_\_\_\_\_ / \_\_\_\_\_

1. \_\_\_\_\_ / \_\_\_\_\_

2. \_\_\_\_\_ / \_\_\_\_\_

**CROP OPTIONS:** Yield/Protein Goal

Crop \_\_\_\_\_ / \_\_\_\_\_

1. \_\_\_\_\_ / \_\_\_\_\_

2. \_\_\_\_\_ / \_\_\_\_\_

**TESTS REQUIRED:** (Circle ONE Package)

Package 1 2 3 4

Phosphorus Method (MB Only)  Organic Matter   
 If required please check:  Colourimetric method   
 Sodium Bicarbonate (Olsen)  Walkley-Black method

Other test(s): Quote # Q56352

**TESTS REQUIRED:** (Circle ONE Package)

Package 1 2 3 4

Phosphorus Method (MB Only)  Organic Matter   
 If required please check:  Colourimetric method   
 Sodium Bicarbonate (Olsen)  Walkley-Black method

Other test(s): Quote # Q56352

**TESTS REQUIRED:** (Circle ONE Package)

Package 1 2 3 4

Phosphorus Method (MB Only)  Organic Matter   
 If required please check:  Colourimetric method   
 Sodium Bicarbonate (Olsen)  Walkley-Black method

Other test(s): Quote # Q56352

**TESTS REQUIRED:** (Circle ONE Package)

Package 1 2 3 4

Phosphorus Method (MB Only)  Organic Matter   
 If required please check:  Colourimetric method   
 Sodium Bicarbonate (Olsen)  Walkley-Black method

Other test(s): Quote # Q56352

**ATTACHMENT 4**



Box 364  
Melita, Manitoba  
R0M 1L0  
P: (204) 522-3413  
F: (204) 522-3587  
tofmel@mymts.net  
[www.melitamb.ca](http://www.melitamb.ca)

Bill Holden MAYOR

Sandra Anderson ADMINISTRATOR

Ray Smithson  
COUNCILLOR

Alby Morris  
COUNCILLOR

Jocelyn Skelton  
COUNCILLOR

Brian Teetaert  
COUNCILLOR

DATE: June 16, 2017

NUMBER OF PAGES: 2 (Including cover sheet)

RECEIVING FAX NUMBER: 1-204-896-0754

TO: Gene Service

FROM: Sandra Anderson

REMARKS:





Box 364  
Melita, Manitoba R0M 1L0  
P: (204) 522-3413  
F: (204) 522-3587  
tofmel@mymts.net  
[www.melitamb.ca](http://www.melitamb.ca)

Bill Holden MAYOR

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Ray Smithson  
COUNCILLOR

Alby Morris  
COUNCILLOR

Jocelyn Skelton  
COUNCILLOR

Brian Teetaert  
COUNCILLOR

Dear Farm Producer,

The Town of Melita requires agricultural land to apply bio solids from the aeration cells at the Town Wastewater Treatment facility. Applying bio solids to agricultural land is a beneficial and sustainable means to manage this organic material. This is a letter agreement to allow land application to occur on the land parcels outlined below. The following outlines the point of this agreement.

1. Each quarter section will need to be soil sampled for nutrients, metals, and salts. Soil sampling will be completed by truck and required for prescription rates.
2. Soil sampling may need to occur more than one occasion and will occur prior to spring seeding or post-harvest.
3. Land application of bio solids will be completed with heavy field equipment and will need good access to the land parcel(s) after crop harvest or prior to spring seeding.
4. If applicable, buffer zones may be left with no bio solid application near property lines, homes, groundwater wells and surface water features as required by the Manitoba Environment Act.
5. Bio solids will be applied at agronomic prescribed rates.
6. Bio solids/sludge may require tillage incorporation shortly after application depending upon the application method.
7. There are no fees to be paid from the Town of Melita to the landowner or lessee for:
  - a) Bio solids/sludge or nutrients
  - b) Use of Land
  - c) Application process
  - d) Tillage requirements
8. Volume of bio solids is not exact, not all the land may be required for application.
9. The landowner has the right to pull out of the program, with sufficient notice (2 weeks).
10. Manitoba Conservation imposes cropping restrictions for a period of three (3) years following the date of bio solid applications to land, the following crops can only be grown; cereal crops, oil seed crop, forage, field peas or lentils.

Legal land location for each parcel: NE 26-3-27, NW 25-3-27, NW 26-03-27  
SE 26-3-27, SW 26-3-27, NE 36-3-27  
NW 25-3-27 c/t # 2739060

Signature: *Beet Klop*

Date: Oct. 27/16



**ATTACHMENT 5**

## Gene Senior

---

**From:** Roy Houston <RHouston@kgsgroup.com>  
**Sent:** June-14-17 3:25 PM  
**To:** gsenior@kgsgroup.com  
**Subject:** FW: Melita

-----Original Message-----

From: Assiniboine [<mailto:info@lagooncleaning.com>]  
Sent: Wednesday, June 14, 2017 3:08 PM  
To: Roy Houston  
Subject: Re: Melita

Hi Roy

We propose to haul the biosolids from the lagoon to the field using sealed end dumps from there we load and spread with a real time scale system spreader For accurate spreading and mapping Within 48 hours we incorporate the biosolids with a disk or deep tiller If you need anything else let me know. Thanks

Mike

Sent from my iPhone

> On Jun 14, 2017, at 2:05 PM, Roy Houston <[RHouston@kgsgroup.com](mailto:RHouston@kgsgroup.com)> wrote:

>

> Mike

>

> I have not heard back yet, will try phoning them again.

>

> Roy

>

>

> -----Original Message-----

> From: Assiniboine [<mailto:info@lagooncleaning.com>]

> Sent: Wednesday, June 14, 2017 12:04 PM

> To: Roy Houston

> Subject: Melita

>

> Hi Roy

> Just wondering if you have heard anything back yet from environment

> for

the

> spreading of biosolids in Melita Or had an idea of when we would get

> approval. Thanks

>

> Mike

>

>

> Sent from my iPhone

**ATTACHMENT 6**

# MEMORANDUM

**TO:** Gene Senior  
**FROM:** Phillip Pawluk / Roy Houston  
**DATE:** June 19, 2017  
**FILE NO:** 16-0429-009  
**RE:** Melita Lagoon – EAP for Land Application of Biosolids – Field Investigation

---

## 1.0 SCOPE OF WORK

The engineering services that have been provided for this project are identified below:

- **Test Hole Excavation and Soil Sampling:** An on-site excavation program was completed on lands NW 25-3-27W1 to investigate the subsurface and groundwater conditions at the site. The excavation program consisted of advancing one (1) test pit to a depth of 2.5 m.
- **Summary Geotechnical Memo:** The following information is provided and/or discussed in this summary geotechnical memo:
  - Detailed test hole summary of site stratigraphy incorporating field observations, laboratory test results and estimated depth of groundwater.

## 2.0 INVESTIGATION PROGRAM

### 2.1 TEST HOLE EXCAVATION AND SOIL SAMPLING PROGRAM

A test hole excavation and sampling program consisting of one (1) test hole was completed on June 2, 2017. Excavation services were provided by C&C Digging of Rathwell, Manitoba with continuous KGS Group supervision. The test hole was completed using a Link-Belt 240 tracked excavator equipped with a standard digging bucket. The approximate location of the test hole is shown on Figure 1 with the approximate UTM coordinates (Zone 14) of the test hole provided on Table 1.

Representative disturbed soil samples were obtained in the test hole at 0.8, 1.5 m and 2.5m depths. Soil samples were collected directly from the excavator bucket cuttings.

Upon completion of the excavation, the test hole was examined for indications of sloughing, squeezing and seepage, and then backfilled to grade. A detailed summary soil log incorporating all field observations details are provided in Appendix A.

**TABLE 1  
APPROXIMATE TEST HOLE COORDINATES AND ELEVATIONS**

TEST HOLE ID	APPROXIMATE UTM COORDINATES		GROUND ELEVATION (m)	DEPTH TO TILL (m)	EXCAVATION DEPTH (m)
	NORTHING	EASTING			
TH17-01	5457055.46	353965.40	N/A	N/A	2.5

**FIGURE 1  
APPROXIMATE TEST HOLE LOCATION**



## 2.2 LABORATORY TESTING

A diagnostic laboratory testing program was performed on select representative soil samples to determine the relevant engineering properties of the subsurface soils which included 2 moisture content tests.

Laboratory testing was completed at a Standards Council of Canada accredited soil testing laboratory in Winnipeg, Manitoba in accordance with ASTM Standards. The results of the laboratory testing are included in Appendix C.

## 2.3 STRATIGRAPHY AND GROUNDWATER CONDITIONS

### 2.3.1 Site Stratigraphy

In general, the stratigraphy at the site has been interpreted by KGS Group to consist of mixed organics and clay overlying high plastic silty clay. The thickness of the mixed organics and clay

is approximately 0.8 m. High plastic silty clay was encountered from the 0.8 m depth to the bottom of the test hole at 2.5 m.

### **Mixed Organics and Clay**

Mixed organics and clay was encountered below the ground surface in the test hole. The thickness of the mixed organics and clay was consistent down to a depth of 0.8 m below ground surface. The mixed organics and clay was consistent. The mixed organics and clay was typically damp and stiff in consistency.

### **Silty Clay (CH)**

Native silty clay was encountered below the mixed organics and clay from 0.8 m to 2.5 m below existing ground surface. The silty clay was medium tan in colour, damp, stiff to very stiff in consistency, of high plasticity and contained minute traces of fine grained gravel.

## **2.3.2 Groundwater Conditions**

While the groundwater was not encountered in the excavation, seepage was encountered while excavating within the clay layer at the 1.5m and 2.5 m below existing ground surface in the test hole.

## **3.0 STATEMENT OF LIMITATIONS THIRD PARTY USE OF REPORT**

This memo has been prepared for KGS Group to whom this report has been addressed and any use a third party makes of this report, or any reliance on or decisions made based on it, are the responsibility of such third parties. KGS Group accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions undertaken based on this report.

### **3.1 STATEMENT OF LIMITATIONS**

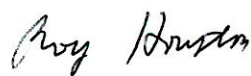
The geotechnical investigation findings and recommendations of this report were prepared in accordance with generally accepted professional engineering principles and practices. The findings and recommendations are based on the results of field and laboratory investigations, combined with an interpolation of soil and groundwater conditions found at and within the depth of the test hole excavated by KGS Group at this site. If conditions encountered during operations appear to be different from those shown by the test hole excavated by KGS Group or if the assumptions stated herein are not in keeping with the design requirements, the office should be notified in order that the recommendations can be reviewed and modified if necessary.

Prepared by:



Phillip Pawluk, B.Sc.(CE), C.E.T., P.Eng.  
Infrastructure Engineer

Reviewed by:



Roy Houston, P.Eng.  
Manager Civil / Municipal Services

PKP/jr


**APPENDIX A**  
**TEST HOLE LOG**



**CLIENT** MANITOBA WATER SERVICES BOARD  
**PROJECT** Town of Melita Lagoon Biosolids Application  
**SITE** Kirkup Farm  
**LOCATION** NW-25-3-27W1  
**DRILLING METHOD** Link Belt 240 Excavator

**JOB NO.** 16-0429-009  
**GROUND ELEV.**  
**TOP OF PVC ELEV.**  
**WATER ELEV.**  
**DATE DRILLED** 02/06/2017  
**UTM (m)** N 5,457,055  
 E 353,965

ELEVATION (m)	DEPTH (m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲ DYNAMIC CONE (N) blows/ft △	Cu POCKET PEN (kPa) ★ Cu TORVANE (kPa) ◆	
							PL	MC LL
			<b>ORGANICS</b> - Mixed organic soil and clay					
	1		<b>CLAY</b> - Solid, stiff clay with low moisture content.	S01				
	5		- Trace silt below 1.5 m.	S02				
	2							
	3		<b>End of Test Hole</b>	S03				
	10		Notes: 1) Water seepage observed at 1.2 m depth. 2) Water seepage observed at 2.5 m depth.					
	4							
	15							
	5							
	6							
	20							
	7							
	25							
	8							
	9							
	30							

SAMPLE TYPE  Auger Grab

CONTRACTOR

INSPECTOR  
**P. PAWLUK**

APPROVED  
DRAFT

DATE  
19/6/17

**APPENDIX B**  
**SITE PHOTOGRAPHS**



Photo 1 – General Site View Looking East



Photo 2 – General Site View With Test Excavation Location Looking East





Photo 3 – Test Excavation Stratigraphy



Photo 4 – Test Excavation Stratigraphy to bottom of Test Hole



**APPENDIX C**  
**LABORATORY TESTING RESULTS**



**Stantec Consulting Ltd.**  
199 Henlow Bay, Winnipeg MB R3Y 1G4

June 9, 2017  
File: 123313152

**Attention Mr. Phil Pawluk**  
KGS Group Inc.  
3<sup>rd</sup> Floor – 865 Waverley St.  
Winnipeg, Manitoba R3T 5P4

Dear Phil,

**Reference: Town of Melita – Lagoon Biosolids (16-0429-009)**

On June 5, 2017, a total of two (2) soil samples were submitted to our laboratory for analysis. The following tests were conducted on selected soil samples:

- Particle-Size Analysis (ASTM D422)
- Liquid Limit (multi-point), plastic limit, and plasticity index (ASTM D4318)

We appreciate the opportunity to assist you in this project. Please call if you have any questions regarding this report.

Regards,

**STANTEC CONSULTING LTD.**

Tabea Kleineberg, M.Sc., GIT  
Geotechnical Technologist  
Phone: (204) 488-6999  
Tabea.kleineberg@stantec.com

Jason Thompson, C.E.T.  
Senior Associate – Team Lead  
Manager, Materials Testing Services  
Phone: (204) 928-4004  
jason.thompson@stantec.com

Attachment: Table 1 - Particle Size Analysis and Atterberg Limits Test Data  
2 x Particle Size Analysis Reports  
2 x Atterberg Limits Reports



June 9, 2017  
 Mr. Phil Pawluk  
 Page 2 of 2

Reference: Town of Melita – Lagoon Biosolids (16-0429-009)

**TABLE 1  
 PARTICLE SIZE ANALYSIS AND ATTERBERG LIMITS TEST DATA**

Sample ID	Sample Depth.	Particle Size Analysis							Atterberg Limits		
		Gravel (%) 75 to 4.75 mm	Sand (%)			Silt (%) <0.075 to 0.002 mm	Clay (%) <0.002 mm	Colloids (%) < 0.001 mm	Liquid Limit	Plastic Limit	Plasticity Index
			Coarse <4.75 to 2.0 mm	Medium <2.0 to 0.425 mm	Fine <0.425 to 0.075 mm						
Sample 1	1.5 m	0.0	0.0	0.1	2.3	48.5	49.1	41.5	63	18	45
Sample 2	2.5 m	0.0	0.0	0.0	3.5	53.3	43.2	36.3	54	16	38

**Notes:**

1. A high speed stirring device was used for 1 minute to disperse the test sample for particle size analysis
2. The soil samples were air-dried during sample preparation for Atterberg limits and particle size analysis





**LABORATORY**

199 Henlow Bay  
 Winnipeg MB R3Y 1G4  
 Tel: (204) 488-6999

**PARTICLE SIZE ANALYSIS  
 ASTM D422**

KGS Group Inc.  
 3rd Floor - 865 Waverley Street  
 Winnipeg, Manitoba  
 R3T 5P4

PROJECT: Town of Melita  
 Lagoon Biosolids  
 16-0429-009

Attention: Phil Pawluk

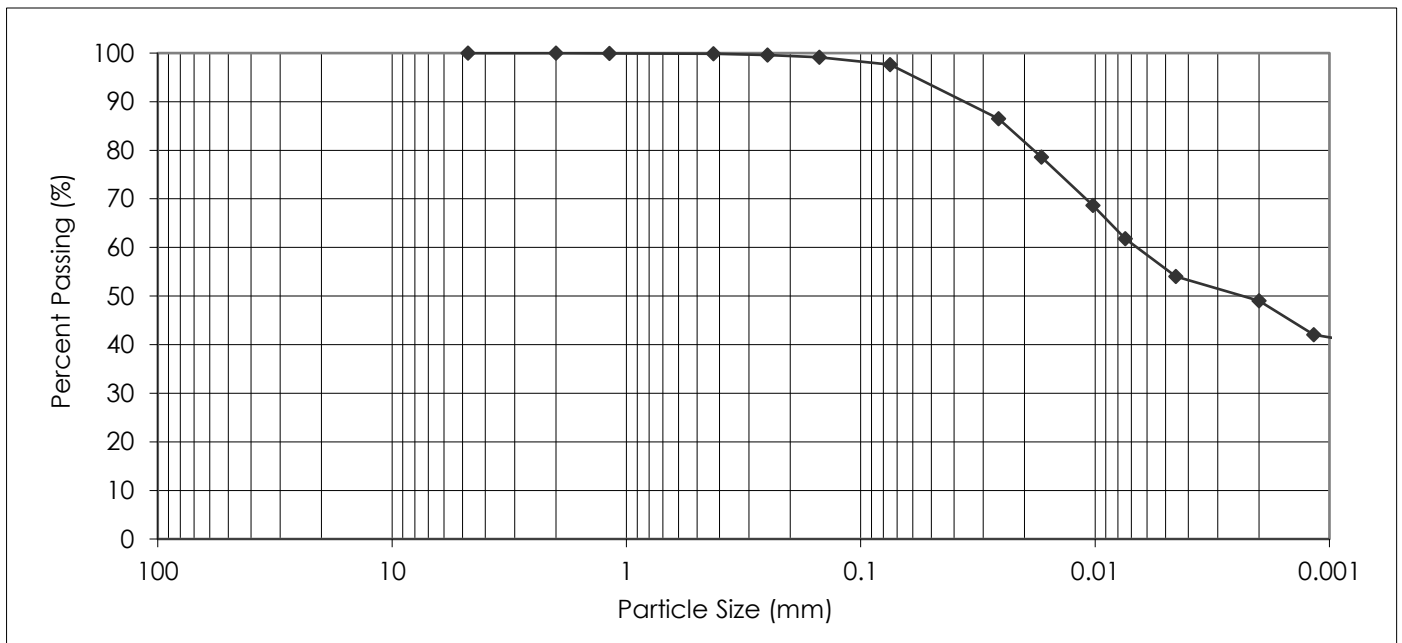
PROJECT NO.: 123313152

SAMPLED BY: Client

DATE RECEIVED: June 5, 2017

SAMPLE ID: Sample 1 - 1.5 m depth

TESTED BY: Nestor Abarca, C.Tech.



PARTICLE SIZE	PERCENT PASSING
37.50 mm	100.0
25.00 mm	100.0
19.00 mm	100.0
16.00 mm	100.0
12.50 mm	100.0
9.50 mm	100.0
4.75 mm	100.0
2.00 mm	100.0

PARTICLE SIZE	PERCENT PASSING
1.18 mm	99.9
0.425 mm	99.9
0.250 mm	99.6
0.150 mm	99.1
0.075 mm	97.6
0.005 mm	55.6
0.002 mm	49.1
0.001 mm	41.5

Gravel, % 75 to 4.75 mm	Sand, %			Silt, % <0.075 to 0.002 mm	Clay, % <0.002 mm	Colloids, % < 0.001 mm
	Coarse <4.75 to 2.0 mm	Medium <2.0 to 0.425 mm	Fine <0.425 to 0.075 mm			
0.0	0.0	0.1	2.3	48.5	49.1	41.5

REPORT DATE: June 9, 2017



REVIEWED BY: *Jason Thompson*  
 Jason Thompson, C.E.T.

Reporting of these test results constitutes a testing service only. Engineering interpretation or evaluation of the test results is provided only on written request. The data presented above is for the sole use of the client stipulated above. Stantec is not responsible, nor can be held liable, for the use of this report by any other party, with or without the knowledge of Stantec.



**LABORATORY**

199 Henlow Bay  
 Winnipeg MB R3Y 1G4  
 Tel: (204) 488-6999

**PARTICLE SIZE ANALYSIS  
 ASTM D422**

KGS Group Inc.  
 3rd Floor - 865 Waverley Street  
 Winnipeg, Manitoba  
 R3T 5P4

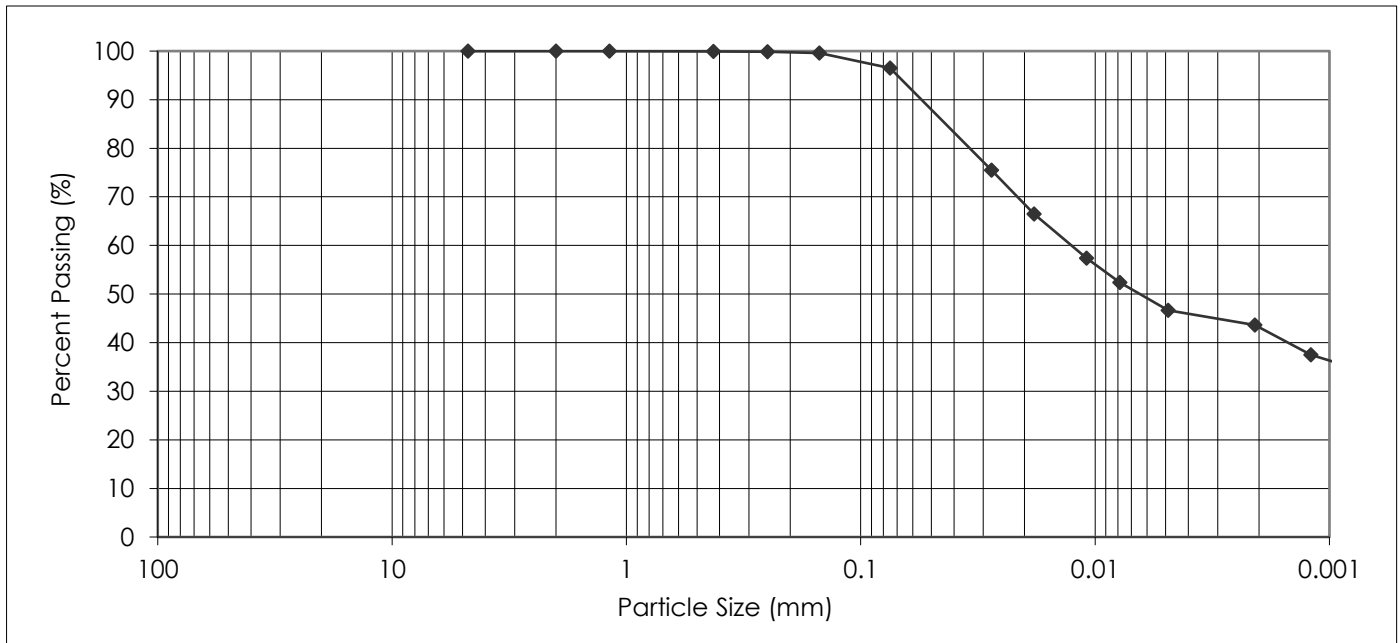
PROJECT: Town of Melita  
 Lagoon Biosolids  
 16-0429-009

Attention: Phil Pawluk

PROJECT NO.: 123313152

SAMPLED BY: Client  
 SAMPLE ID: Sample 2 - 2.5 m

DATE RECEIVED: June 5, 2017  
 TESTED BY: Nestor Abarca, C.Tech.



PARTICLE SIZE		PERCENT PASSING		PARTICLE SIZE		PERCENT PASSING	
37.50 mm		100.0		1.18 mm		100.0	
25.00 mm		100.0		0.425 mm		100.0	
19.00 mm		100.0		0.250 mm		99.9	
16.00 mm		100.0		0.150 mm		99.6	
12.50 mm		100.0		0.075 mm		96.5	
9.50 mm		100.0		0.005 mm		46.9	
4.75 mm		100.0		0.002 mm		43.2	
2.00 mm		100.0		0.001 mm		36.3	
Gravel, % 75 to 4.75 mm	Sand, %			Silt, % <0.075 to 0.002 mm	Clay, % <0.002 mm	Colloids, % < 0.001 mm	
	Coarse <4.75 to 2.0 mm	Medium <2.0 to 0.425 mm	Fine <0.425 to 0.075 mm				
0.0	0.0	0.0	3.5	53.3	43.2	36.3	

REPORT DATE: June 9, 2017



REVIEWED BY: *Jason Thompson*  
 Jason Thompson, C.E.T.

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**Atterberg Limits**  
 ASTM D4318  
 Method A- Multi-Point

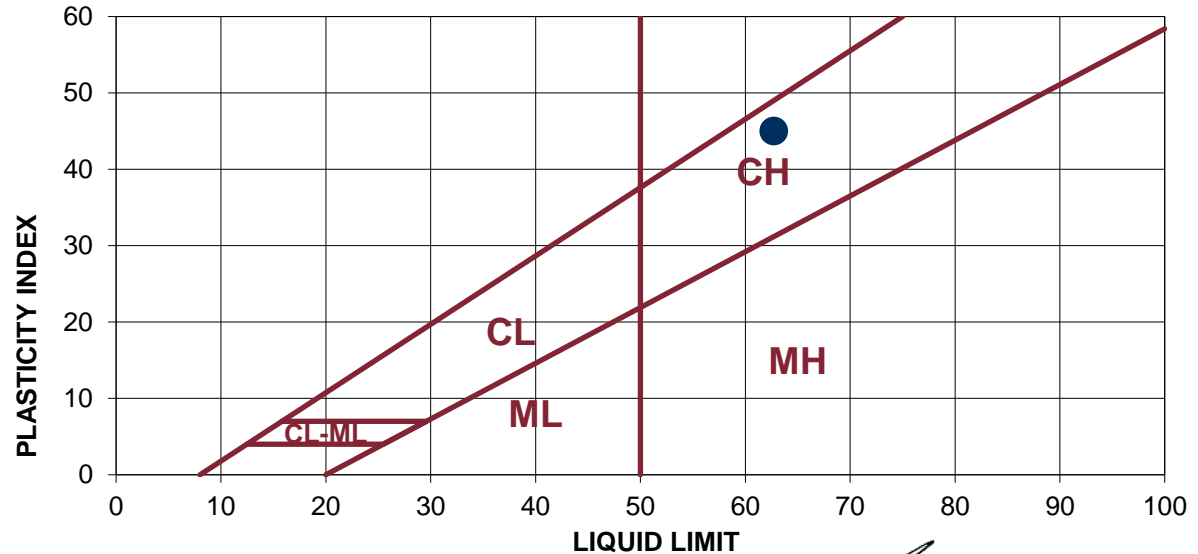
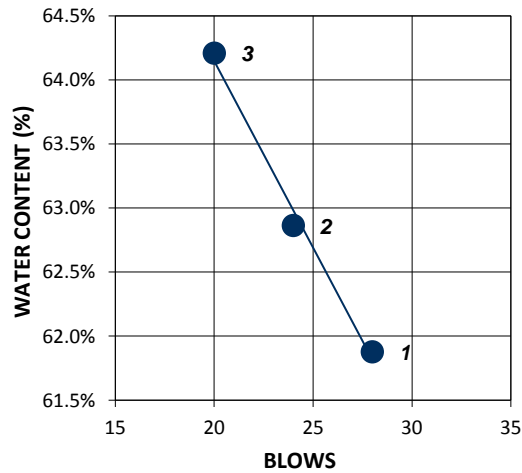
Client: KGS Group Inc.  
 Project Name: Town of Melita Lagoon Biosolids (16-0429-009)  
 Project No: 123313152  
 Date Received: June 5, 2017  
 Date Tested: June 7, 2017  
 Tested By: Nestor Abarca, C.Tech.

**LABORATORY**  
 199 Henlow Bay

Winnipeg, Manitoba  
 Canada R3Y 1G4  
 Tel: (204) 488-6999

Sample : Sample 1 - 1.5 m depth

LIQUID LIMIT				PLASTIC LIMIT			RESULTS		
Trial	1	2	3	Trial	1	2	LL	63	
No. of Blows	28	24	20	Tare No.	297	303	PL	18	
Tare No.	165	185	213	Wt. Sa. (wet+tare)(g)	29.48	31.51	PI	45	
Wt. Sa. (wet+tare)(g)	39	39	38	Wt. Sa. (dry+tare)(g)	28.17	29.9	Natural MC (%)		
Wt. Sa. (dry+tare)(g)	32	31	31	Wt. Tare (g)	20.93	20.98	36.7%		
Wt. Tare (g)	20	19	20	Wt. Dry Soil (g)	7.2	8.9			
Wt. Dry Soil (g)	12.0	12.1	11.0	Wt. Water (g)	1.3	1.6			
Wt. Water (g)	7.5	7.6	7.1	Water Content (%)	18.1%	18.0%			
Water Content (%)	61.9%	62.9%	64.2%						



Reviewed By: *Jason Thompson*  
 Jason Thompson, C.E.T.

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**Atterberg Limits**  
 ASTM D4318  
 Method A- Multi-Point

Client: KGS Group Inc.  
 Project Name: Town of Melita Lagoon Biosolids (16-0429-009)  
 Project No: 123313152  
 Date Received: June 5, 2017  
 Date Tested: June 7, 2017  
 Tested By: Nestor Abarca, C.Tech.

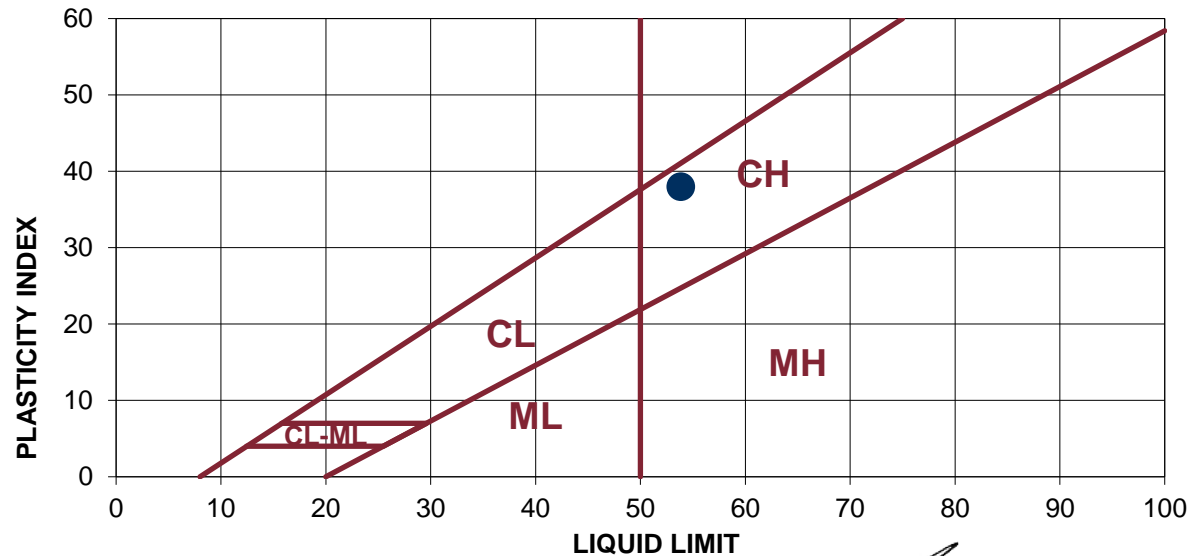
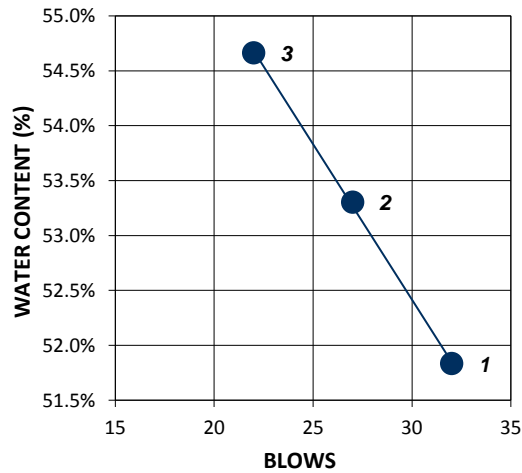
**LABORATORY**  
 199 Henlow Bay

Winnipeg, Manitoba  
 Canada R3Y 1G4  
 Tel: (204) 488-6999

Sample : Sample 2 - 2.5 m depth

LIQUID LIMIT				PLASTIC LIMIT		
Trial	1	2	3	Trial	1	2
No. of Blows	32	27	22	Tare No.	293	319
Tare No.	238	258	279	Wt. Sa. (wet+tare)(g)	31.51	32.72
Wt. Sa. (wet+tare)(g)	44	39	38	Wt. Sa. (dry+tare)(g)	30.06	31.09
Wt. Sa. (dry+tare)(g)	36	33	32	Wt. Tare (g)	21.02	20.95
Wt. Tare (g)	21	20	20	Wt. Dry Soil (g)	9.0	10.1
Wt. Dry Soil (g)	15.0	12.3	11.6	Wt. Water (g)	1.5	1.6
Wt. Water (g)	7.8	6.5	6.3	Water Content (%)	16.0%	16.1%
Water Content (%)	51.8%	53.3%	54.7%			

RESULTS	
LL	<b>54</b>
PL	<b>16</b>
PI	<b>38</b>
Natural MC (%)	
26.6%	



Reviewed By: Jason Thompson, C.E.T.

Reporting of these test results constitutes a testing service only. Engineering interpretation or evaluation of the test results is provided only on written request. The data presented above is for the sole use of the client stipulated above. STANTEC is not responsible, nor can be held liable, for the use of this report by any other party, with or without the knowledge of STANTEC.