



18-360 Portage Avenue • Winnipeg, Manitoba Canada • R3C 0G8
Telephone / N° de téléphone : (204) 360 7917 • Fax / N° de télécopieur : (204) 360 6138
relder@hydro.mb.ca

2018 08 10

Siobhan Burland Ross
A/Director - Environmental Approvals Branch
Manitoba Sustainable Development
1007 Century Street
Winnipeg, MB R3H 0W4



Dear Ms. Burland Ross:

**KEEWATINOHK CONSTRUCTION CAMP LAGOON – ALTERATION REQUEST
DISPOSAL OF SLUDGE VIA LAND APPLICATION AND ABANDONMENT OF SEWER MAIN
EAL No. 3015, CLIENT FILE No. 5573.00**

Manitoba Hydro is requesting an alteration to Environment Act Licence (EAL) No. 3015 during the decommissioning phase of the lagoon to:

- Dispose of the sludge from the primary cell of the lagoon by means of land application; and
- Abandon a low pressure sewer main buried at 3.5m depth.

Please see the attached for a description of the work and potential environmental effects.

If you require any clarification or any additional information, please contact Jodine MacDuff at (204) 360 5539.

Yours truly,

Rob Elder, P. Eng.
Director, Bipole III Converter Stations
Transmission

Att.



**Keewatinohk Construction Camp
Wastewater Management System and Wastewater Treatment Lagoon**

Notice of Alteration to Environment Act Licence No. 3015 – Decommissioning of Lagoon

Manitoba Hydro is requesting an alteration to Environment Act Licence (EAL) No. 3015 during the decommissioning phase of the lagoon to:

- Dispose of the sludge from the primary cell of the lagoon by means of land application; and
- Abandon a Low Pressure Sewer Main buried at 3.5m depth.

Background

Clause 60 (d) of EAL 3015 states that the Licencee shall *“dispose of the sludge and all materials and ancillary components from the wastewater treatment lagoon that cannot be recycled at a waste disposal ground operated under the authority of: i) a permit issued under the Manitoba Regulation 150/91 respecting Waste Disposal Grounds; or ii) A licence issued pursuant to The Environment Act”*.

Clause 60 (e) states that the Licencee shall *“remove the synthetic liners, gas and groundwater relief system, and all ancillary components associated with the operation of the wastewater treatment lagoon from the wastewater treatment lagoon”*.

Description of Request

Disposal of Sludge via Land Application

Collection and dewatering of the sludge from the primary cell will take place in September of 2018, the anticipated volume of the sludge is approximately 1200 m³. The sludge will be dewatered utilizing a centrifuge with the liquid directed to the secondary cell.

As noted in EAL No. 3015, the dewatered sludge was to be disposed of at a waste disposal ground. To reduce the hauling distances required to dispose of the sludge, it is proposed to utilize the sludge as a land amendment in Excavated Material Placement Area (EMPA) 1C and 1E which are approximately 0.5 km and 4.5 km from the lagoon respectively, refer to Figure 1. It is anticipated that all sludge will be land applied by late October, before the ground freezes.

The primary cell will not be dewatered until September; therefore sludge samples from the primary cell were collected in situ on July 17, 2018. Samples were collected at the inlet pipe and the truck dump as shown on Figure 2 and submitted to ALS Environmental for analysis. Parameters analyzed were consistent with those specified in the Neepawa Wastewater Treatment Lagoon – Biosolids to Farmland Environment Act Licence No. 2706. Refer to Appendix A for the Certificate of Analysis

EMPA 1C is approximately seven ha and EMPA 1E is approximately fourteen ha and both consist of deposits of mixed clay and peat soils. Both areas are surrounded by a berm. Planting of jack pines is scheduled to occur in spring/summer of 2019 for both EMPAs. Soil samples were collected from EMPA 1C and 1E on July 18, 2018. Twelve representative sites were sampled at 0 - 30cm depth and bulked into one sample per EMPA. The two bulked samples (representing each EMPA) were then sent to ALS Environmental and Maxxam for analysis; refer to Appendix B for the Certificate of Analysis.

The application rate for sludge has been calculated so as not to exceed the limits described in Environment Act Licence No. 2706 Neepawa Biosolids application. Based on test results as in Appendix A and B, and conditions in EAL 2706, the application rate will be at a maximum of 15 tonnes dry weight per ha. This is based on the General Term and Condition 16 from Environment Act Licence No.2706, as the other test parameters are sufficient so as to not exceed any other condition. Once applied, sludge will be tilled into the surface material.

Abandonment of Low Pressure Sewer Main

As noted in Clause 60 (e) of EAL No. 3015, all buried pipes were to be removed from the site. Manitoba Hydro is proposing to leave approximately 700 m of the low pressure sewer main from the lift station to the check valve manhole (Figure 3). This pipe is buried at a depth of approximately 3.5 m along the access road ditch and removing it would cause significant disturbance to the surrounding area. The low pressure sewer main is a 150 mm diameter HDPE (High Density Polyethylene) polyurethane pre-insulated and electrical heat traced sewer pipe with an HDPE outer jacket. With insulation the outside diameter is approximately 250 mm.

Potential Environmental Effects

As seen in Appendices A and B, the levels of heavy metals and nutrients are well within the acceptable limits. As the EMPA is composed of deposits of the local nutrient poor soil, the application of the sludge will provide much needed nutrients which are expected to have a positive effect on natural re-vegetation within the disturbed area. The extra depth of the EMPA

soils will ensure groundwater is not affected and the berm surrounding the EMPA will contain any possible run off within the area.

The low pressure sewer main is composed of inert materials, and the depth of the pipe is such that it will not be disturbed by natural processes. Removing the pipe would have caused a significant disturbance to the surrounding soils, and led to a greater risk of erosion. Abandoning the Main will allow for much more shallow soil disturbance during decommissioning, decreasing risk of erosion.

Summary

In conclusion, the proposed plan to dispose of the sludge from the primary cell of the lagoon by means of land application and the abandonment of the Low Pressure Sewer Main will not have a significant environmental effect on the local or surrounding areas.



Figure 1: Location of EMPA 1C and EMPA 1E in relation to Primary Cell of Lagoon

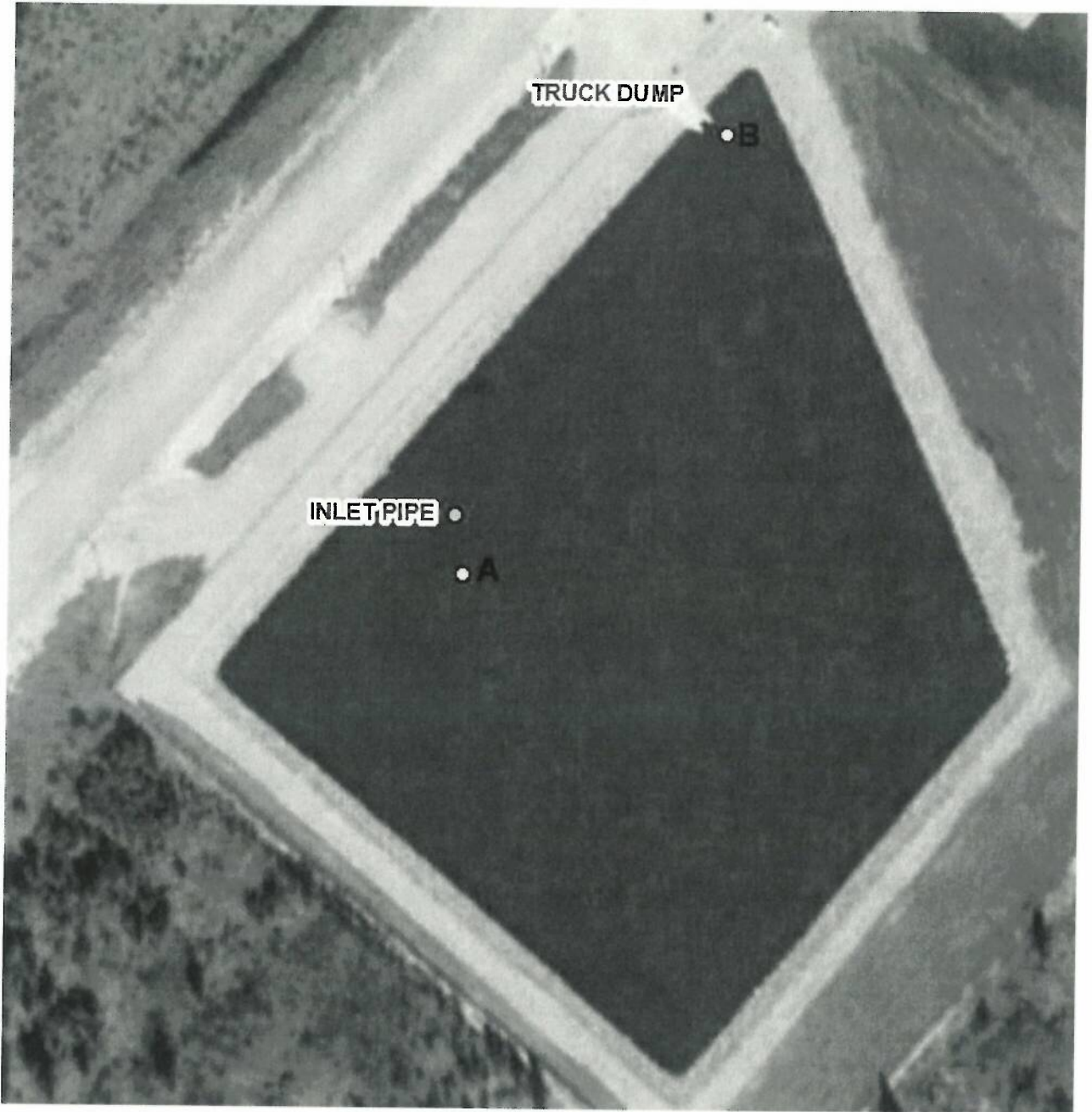
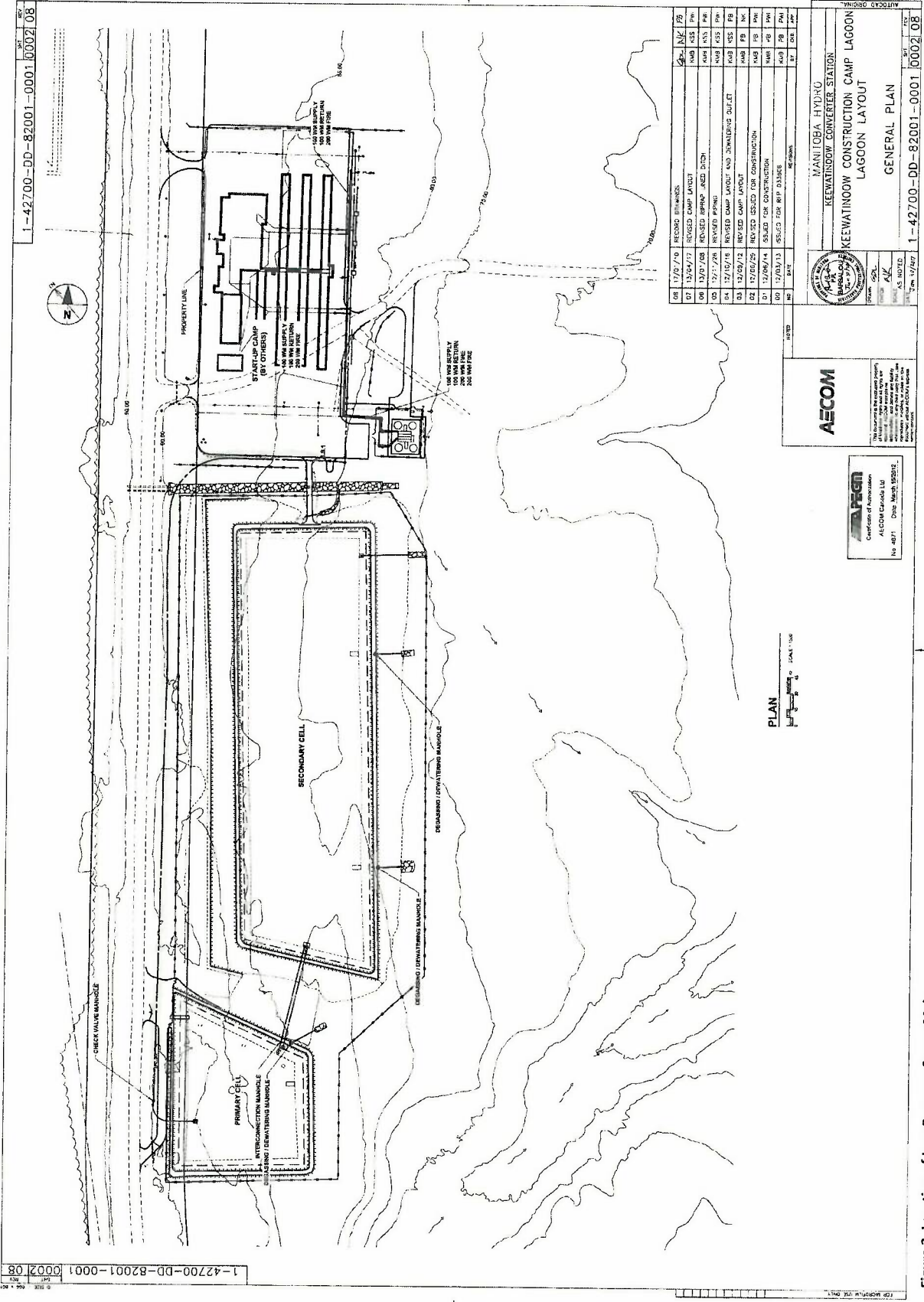


Figure 2. Sludge sampling locations



1-42700-DD-82001-0001 0002 08

1-42700-DD-82001-0001 0002 08

NO.	DATE	DESCRIPTION	BY	CHK.
08	17/07/18	ISSUED FOR PERMITS	AK	PK
07	13/04/17	REVISED CAMP LAYOUT	AK	PK
06	13/04/17	REVISED DRAINAGE DITCH	AK	PK
05	12/07/16	REVISED PAVING	AK	PK
04	12/07/16	REVISED CAMP LAYOUT AND DRAINAGE DITCH	AK	PK
03	12/07/16	REVISED CAMP LAYOUT	AK	PK
02	12/06/14	REVISED ISSUED FOR CONSTRUCTION	AK	PK
01	12/06/14	ISSUED FOR CONSTRUCTION	AK	PK
00	17/03/13	ISSUED FOR RFP 031848	AK	PK

MANITOBA HYDRO
KEEWATINOW CONVERTER STATION
KEEWATINOW CONSTRUCTION CAMP LAGOON
LAGOON LAYOUT
GENERAL PLAN

AS NOTED
DATE 17/07/18

AECOM

Professional Corporation
1111 15th Street, Suite 1000
Winnipeg, MB R2P 2Y9
Tel: 204.984.4600
Fax: 204.984.4601
www.aecom.com

PCSN
Certificate of Authorization
AECOM Canada Ltd.
No. 4871 Date: March 19/2012

PLAN
SCALE 1:500

Figure 3. Location of Low Pressure Sewer Main

Appendix A: Sludge Samples Certificate of Analysis



Sodexo Canada Ltd
ATTN: DAVE HOUSTON
Keewatinooow S2 Water Treatment
Box 40
Gillam MB R0B 0L0

Date Received: 19-JUL-18
Report Date: 27-JUL-18 10:34 (MT)
Version: FINAL

Client Phone: 204-939-1263

Certificate of Analysis

Lab Work Order #: L2132481
Project P.O. #: NOT SUBMITTED
Job Reference: KEEWATINOOW LAGOON SLUDGE
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 An ALS Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2132481-1 LAGOON SLUDGE							
Sampled By: DH on 17-JUL-18 @ 16:00							
Matrix: Sludge Liquid							
Miscellaneous Parameters							
Ammonia, Total (as N)	63.8		4.0	mg/L		25-JUL-18	R4142771
Conductivity	2250		1.0	umhos/cm		20-JUL-18	R4136327
Nitrate (as N)	<0.40	DLM	0.40	mg/L		21-JUL-18	R4141610
Phosphorus (P)-Total	227		1.0	mg/L		24-JUL-18	R4139681
Total Kjeldahl Nitrogen	2070		200	mg/L	20-JUL-18	23-JUL-18	R4137971
Total Suspended Solids	77900		150	mg/L		24-JUL-18	R4140196
Volatile Suspended Solids	30500		150	mg/L		24-JUL-18	R4142235
pH, Client Supplied	6.87		0.10	pH		27-JUL-18	R4144602
Total Metals in Water by CRC ICPMS							
Aluminum (Al)-Total	691	DLM	0.15	mg/L	23-JUL-18	23-JUL-18	R4139615
Antimony (Sb)-Total	0.0456	DLM	0.0050	mg/L	23-JUL-18	23-JUL-18	R4139615
Arsenic (As)-Total	0.498	DLM	0.0050	mg/L	23-JUL-18	23-JUL-18	R4139615
Barium (Ba)-Total	20.9	DLM	0.0050	mg/L	23-JUL-18	23-JUL-18	R4139615
Beryllium (Be)-Total	0.0110	DLM	0.0050	mg/L	23-JUL-18	23-JUL-18	R4139615
Bismuth (Bi)-Total	0.543	DLM	0.0025	mg/L	23-JUL-18	23-JUL-18	R4139615
Boron (B)-Total	0.99	DLM	0.50	mg/L	23-JUL-18	23-JUL-18	R4139615
Cadmium (Cd)-Total	0.0370	DLM	0.00025	mg/L	23-JUL-18	23-JUL-18	R4139615
Calcium (Ca)-Total	4770	DLM	2.5	mg/L	23-JUL-18	23-JUL-18	R4139615
Cesium (Cs)-Total	0.0400	DLM	0.00050	mg/L	23-JUL-18	23-JUL-18	R4139615
Chromium (Cr)-Total	1.42	DLM	0.0050	mg/L	23-JUL-18	23-JUL-18	R4139615
Cobalt (Co)-Total	0.505	DLM	0.0050	mg/L	23-JUL-18	23-JUL-18	R4139615
Copper (Cu)-Total	15.4	DLM	0.025	mg/L	23-JUL-18	23-JUL-18	R4139615
Iron (Fe)-Total	896	DLM	0.50	mg/L	23-JUL-18	23-JUL-18	R4139615
Lead (Pb)-Total	0.940	DLM	0.0025	mg/L	23-JUL-18	23-JUL-18	R4139615
Lithium (Li)-Total	0.593	DLM	0.050	mg/L	23-JUL-18	23-JUL-18	R4139615
Magnesium (Mg)-Total	1480	DLM	0.25	mg/L	23-JUL-18	23-JUL-18	R4139615
Manganese (Mn)-Total	33.1	DLM	0.0050	mg/L	23-JUL-18	23-JUL-18	R4139615
Molybdenum (Mo)-Total	0.130	DLM	0.0025	mg/L	23-JUL-18	23-JUL-18	R4139615
Nickel (Ni)-Total	7.82	DLM	0.025	mg/L	23-JUL-18	23-JUL-18	R4139615
Potassium (K)-Total	173	DLM	2.5	mg/L	23-JUL-18	23-JUL-18	R4139615
Phosphorus (P)-Total	399	DLM	2.5	mg/L	23-JUL-18	23-JUL-18	R4139615
Rubidium (Rb)-Total	0.860	DLM	0.010	mg/L	23-JUL-18	23-JUL-18	R4139615
Selenium (Se)-Total	0.0547	DLM	0.0025	mg/L	23-JUL-18	23-JUL-18	R4139615
Silicon (Si)-Total	506	DLM	5.0	mg/L	23-JUL-18	23-JUL-18	R4139615
Silver (Ag)-Total	0.0203	DLM	0.00050	mg/L	23-JUL-18	23-JUL-18	R4139615
Sodium (Na)-Total	432	DLM	2.5	mg/L	23-JUL-18	23-JUL-18	R4139615
Strontium (Sr)-Total	10.3	DLM	0.010	mg/L	23-JUL-18	23-JUL-18	R4139615
Sulfur (S)-Total	382	DLM	25	mg/L	23-JUL-18	23-JUL-18	R4139615
Tellurium (Te)-Total	<0.010	DLM	0.010	mg/L	23-JUL-18	23-JUL-18	R4139615
Thallium (Tl)-Total	0.00886	DLM	0.00050	mg/L	23-JUL-18	23-JUL-18	R4139615
Thorium (Th)-Total	0.0079	DLM	0.0050	mg/L	23-JUL-18	23-JUL-18	R4139615
Tin (Sn)-Total	0.0787	DLM	0.0050	mg/L	23-JUL-18	23-JUL-18	R4139615
Titanium (Ti)-Total	10.5	DLM	0.015	mg/L	23-JUL-18	23-JUL-18	R4139615
Tungsten (W)-Total	0.0149	DLM	0.0050	mg/L	23-JUL-18	23-JUL-18	R4139615
Uranium (U)-Total	0.0408	DLM	0.00050	mg/L	23-JUL-18	23-JUL-18	R4139615
Vanadium (V)-Total	1.13	DLM	0.025	mg/L	23-JUL-18	23-JUL-18	R4139615
Zinc (Zn)-Total	37.8	DLM	0.15	mg/L	23-JUL-18	23-JUL-18	R4139615
Zirconium (Zr)-Total	0.0476	DLM	0.0030	mg/L	23-JUL-18	23-JUL-18	R4139615
Total Organic Nitrogen							
Total Organic Nitrogen (Calculation)							
Total Organic Nitrogen	2010		200	mg/L		26-JUL-18	

* 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
L2132481-1 LAGOON SLUDGE Sampled By: DH on 17-JUL-18 @ 16:00 Matrix: Sludge Liquid							

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

Reference Information

Qualifiers for Sample Submission Listed:

Qualifier	Description
LPML	Lab-Preserved for Total Metals. Sample received with pH > 2 and preserved at the lab. Total Metals results may be biased low.

Sample Parameter Qualifier Key:

Qualifier	Description
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
EC-SCREEN-WP	Water	Conductivity Screen (Internal Use Only)	APHA 2510
Qualitative analysis of conductivity where required during preparation of other test eg. IC, TDS, TSS, etc			
EC-WP	Water	Conductivity	APHA 2510B
Conductivity of an aqueous solution refers to its ability to carry an electric current. Conductance of a solution is measured between two spatially fixed and chemically inert electrodes.			
MET-T-CCMS-WP	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod.)
Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.			
N-T-ORG-CALC-WP	Water	Total Organic Nitrogen (Calculation)	APHA 4500-NORG (TKN)/NH3-NITROGEN (NH3)
Total Organic Nitrogen is a calculated parameter. Total Organic Nitrogen = Total Kjeldahl Nitrogen - Ammonia.			
N-TOTKJ-WP	Water	Total Kjeldahl Nitrogen	APHA 4500 NorgD (modified)
Aqueous samples are digested in a block digester with sulfuric acid and copper sulfate as a catalyst. Total Kjeldahl Nitrogen is then analyzed using a discrete analyzer with colorimetric detection.			
NH3-COL-WP	Water	Ammonia by colour	APHA 4500 NH3 F
Ammonia in water samples forms indophenol when reacted with hypochlorite and phenol. The intensity is amplified by the addition of sodium nitroprusside and measured colourmetrically.			
NO3-IC-N-WP	Water	Nitrate in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
P-T-L-COL-WP	Water	Phosphorus, Total	APHA 4500 P PHOSPHORUS-L
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorous is determined colourmetrically after persulphate digestion of the sample.			
PH-CLIENT-WP	Water	pH supplied by Client	Supplied by client
SOLIDS-TOTSUS-WP	Water	Total Suspended Solids	APHA 2540 D (modified)
Total suspended solids in aqueous matrices is determined gravimetrically after drying the residue at 103 - 105 C.			
SOLIDS-VOLSUS-WP	Water	Volatile Suspended Solids	APHA 2540 E (modified)
Volatile suspended solids in aqueous matrices is determined gravimetrically after igniting the residue at 550 C.			

** 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
WP	ALS ENVIRONMENTAL - WINNIPEG, MANITOBA, 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.



Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

www.alsglobal.com



L2132481-COFC

COC Number: 17 - 680850

Page of

Report To: **Sodexo**
 Company: **Dave Houston**
 Contact: **807-889-0177**
 Phone: **Box 40**
 Street: **Gillam MB**
 City/Province: **KABOLO**
 Postal Code: **Same as Report To**
 Invoice To: **Copy of Invoice with Report**
 Company: **Sodexo**
 Contact: **Jim Zaleski**
 Project Information: **ALS Account # / Quote #: 30990**
 Job #: **PO / AFE:**
 LSD: **ALS Lab Work Order # (lab use only):**
 Sample Identification and/or Coordinates: **Lagoon Sludge**
pH 6.87
July 18 16:00 GRAB
 Sampler: **DH**
 Date: **July 18 16:00**
 Time (hh:mm): **16:00**
 Sample Type: **GRAB**

Report Format / Distribution: **PDF** **EXCEL** **EDD (DIGITAL)**
 Quality Control (QC) Report with Report: **YES** **NO**
 Compare Results to Chain of Report - provide details below if box checked
 Select Distribution: **EMAIL** **MAIL** **FAX**
 Email 1 or Fax: **SEE MAILING LIST**
 Email 2: **SEE MAILING LIST**
 Email 3: **SEE MAILING LIST**

Select Invoice Distribution: **EMAIL** **MAIL** **FAX**
 Email 1 or Fax: **SEE MAILING LIST**
 Email 2: **SEE MAILING LIST**

Oil and Gas Required Fields (client use)
 AFE/Coast Center: **SEE MAILING LIST**
 Major/Intr Code: **SEE MAILING LIST**
 Requisition #: **SEE MAILING LIST**
 Location: **SEE MAILING LIST**

ALS Contact: **DH**
 Date: **July 18 16:00**
 Time (hh:mm): **16:00**
 Sample Type: **GRAB**

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
please enter pH on final Report

Drinking Water (DW) Samples (client use)
 Are samples taken from a Regulated DW System? **YES** **NO**
 Are samples for human consumption/ use? **YES** **NO**

SHIPMENT RELEASE (client use)
 Received by: **D Houston** Date: **Jul 18 18:30**
 Received by: **GRU** Date: **07/19/18**
 Time: **12:00**
 Date: **07/19/18**

SHIPPING INFORMATION
 REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION
 Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.
 1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)
 Regular [R] Standard TAT if received by 3 pm - business days - no surcharges apply
 4 day [P4-20%] 1 Business day [E-100%]
 3 day [P3-25%] Same Day, Weekend or Statutory holiday [E2-200%]
 2 day [P2-50%] (Laboratory opening fees may apply)
 Date and Time Required for all E&P TATs: **dd-mm-yy hh:mm**
 For tests that cannot be performed according to the service level selected, you will be contacted. : -

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (FP) below	Analysis Request	SAMPLES ON HOLD	NUMBER OF CONTAINERS
	Conductivity		
	Total Solids		
	Nitrate Nitrogen		
	TKN		
	ammonia nitrogen		
	organic nitrogen		
	total phosphorus		
	Metals		

Sample Condition AS RECEIVED (lab use only)
 Frozen SIF Observations Yes No
 Ice Packs Ice Cubes Custody seal intact Yes No
 Cooling Initiated
 INITIAL COOLER TEMPERATURES °C: **12.4**
 FINAL COOLER TEMPERATURES °C: **12.00**

FINAL SHIPMENT RECEPTION (lab use only)
 Received by: **D Houston** Date: **07/19/18**
 Time: **12:00**
 Date: **07/19/18**

www.alsglobal.com

WHITE - LABORATORY COPY
 YELLOW - CLIENT COPY

Appendix B: Soil Samples Certificate of Analysis



Certificate of Analysis Report

Lab Reference #: **S1802994**

*MH-SoilAssess - GO - Bipole III/Keewatinow Project

Report To: Keewatinohk CS SharePoint
MH - Soil Assessment

Fax:
Phone:
Email: som.tr.kcs@smail2010.hydro.mb.ca

Report Evaluation:

S1802994-001

Sample Description: EMPA 1E

Sample Location: Keewatinohk CS lagoon

Remarks:

Profile: Soils
Sample Date: 2018/07/18
Customer Container# : EMPA 1E (1A and 1B)

Sampled By: David Hardisty
Required by 2018/08/03

Test Results

Analyte	Result	Units	Analysis Date	Analyst
Lagoon decommissioning, soil				
pH	8.00	Units		N/R
Pottasium	840	mg/kg DWt		N/R
Nickel	10.0	mg/kg DWt		N/R
Mercury	< 0.05	mg/kg DWt		N/R
Zinc	19.0	mg/kg DWt		N/R
Cadmium	0.100	mg/kg DWt		N/R
Chromium	14.0	mg/kg DWt		N/R
Copper	8.00	mg/kg DWt		N/R
Lead	3.60	mg/kg DWt		N/R
Arsenic	2.10	mg/kg DWt		N/R
Nitrate-N	< 2	mg/Kg(ppm)		N/R
Nitrogen, total	< 0.2	%		N/R
% Sand	62.3	%		N/R
% Silt	26.6	%		N/R
% Clay	11.1	%		N/R

Outsource Lab: Maxxam

Sodium bicarbonate extractable phosphorous, as P

Sodium bicarbonate extractable phosphorous, as P	3.70	mg/kg DWt		N/R
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Outsource Lab: ALS Environmental

S1802994-002

Sample Description: EMPA 1C

Sample Location: Keewatinohk CS lagoon

Remarks:

Profile: Soils
Sample Date: 2018/07/18
Customer Container# : EMPA 1C (1A and 1B)

Sampled By: David Hardisty
Required by 2018/08/03

Test Results

Analyte	Result	Units	Analysis Date	Analyst
Lagoon decommissioning, soil				
pH	7.92	Units		MDALMAIJER
Pottasium	1300	mg/kg DWt		MDALMAIJER
Nickel	17.0	mg/kg DWt		MDALMAIJER
Mercury	< 0.05	mg/kg DWt		MDALMAIJER
Zinc	27.0	mg/kg DWt		MDALMAIJER
Cadmium	0.150	mg/kg DWt		MDALMAIJER
Chromium	26.0	mg/kg DWt		MDALMAIJER
Copper	12.0	mg/kg DWt		MDALMAIJER
Lead	5.00	mg/kg DWt		MDALMAIJER
Arsenic	2.90	mg/kg DWt		MDALMAIJER
Nitrate-N	< 2	mg/Kg(ppm)		MDALMAIJER
Nitrogen, total	< 0.2	%		MDALMAIJER
% Sand	56.8	%		MDALMAIJER
% Silt	25.7	%		MDALMAIJER
% Clay	17.6	%		MDALMAIJER

Outsource Lab: Maxxam

Sodium bicarbonate extractable phosphorous, as P

Sodium bicarbonate extractable phosphorous, as P	3.90	mg/kg DWt		MDALMAIJER
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Outsource Lab: ALS Environmental

METHOD: Default

Report Authorized by: Mark Dalmaijer

Release Date: 2018/08/03

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- Note:
- < means the analyte cannot be reliably determined to be present at or below the reporting detection limit.
 - The results in this report apply to the samples submitted. Report shall not be reproduced except in whole unless written permission is obtained from the laboratory.
 - Samples are destroyed 90 days after the report is issued unless requested in writing to be held.
 - The method uncertainty will be provided upon request. Please respond to this email with any question you may have regarding method uncertainty.
 - In order to improve our management system, testing activities and customer service, please respond to this email with any comments that you may have.