

MMM Group Limited
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November 12, 2015

Ref. No.: 3315446-000.700

Ms. Tracey Braun
Director
Manitoba Conservation and Water Stewardship
Environmental Approvals
2nd Floor, 123 Main Street
Winnipeg MB R3C 1A5

Dear Mr. Boswick:

RE: Notice of Alteration – Environment Act Licence #2634 to Allow for a One Time Landfill Disposal of Wastewater Lagoon Solids

Introduction

MMM Group Limited (MMM) has been retained by the Rural Municipality of Springfield (RM of Springfield) to complete a Notice of Alteration for Environmental Act License #2634 (EAL #2634) to allow for a one time landfill disposal of raw solids from the RM of Springfield Regional Lagoon located at NE11-11-05EPM.

The scope of work for this project included:

- Quantity verification – quantity verification of the solids in the immediate vicinity of the truck unloading ramps at both Cell 1 and Cell 2.
- Solids suitability for landfill – slump testing on the solids to determine degree of material slumping, moisture and solids content.
- Nutrient and metal profile – complete a nutrient and metals profile through composite sampling of solids material. Conductivity, pH, total solids and volatile solids to be included.
- Liaise with Prairie Green Landfill to determine requirement for landfill disposal of municipal lagoon solids material and seek written permission for disposal at said landfill.

Cell 1 and Cell 2 at the RM of Springfield Regional Lagoon are each equipped with an unloading ramp for waste haulers to release their contents into the lagoons. Due to its continuous use, a build-up of excessive raw sludge and solid materials has occurred at the base and nearby shoreline at each ramp (See Photo 1 and 2).

On behalf of the RM of Springfield, we request approval to allow a one-time landfill disposal of wastewater lagoon solids from the RM of Springfield Regional Lagoon unloading ramps. The intent

is to dispose of this raw sludge material at the Prairie Green Landfill (EAL #2177E RRRR), a subsidiary of Progressive Waste Solutions.

Options Review

Options considered for managing the raw sludge included:

- 1) Translocation of solids within Cell 1 and Cell 2:
 - Relocating the solids material within each cell would require multiple operations to effectively translocate this method and would likely be cost prohibitive and not allow for the accomplishment of the long-term objective.
- 2) Land application:
 - The solids remain too raw for land application and analytical analysis has demonstrated that the solids content is not appropriate for land application (limited by heavy metal concentrations).
- 3) Landfilling:
 - An effective method that removes the material completely from the cell and achieves the objective for the continued long term use of the truck unloading areas.

Quantity Verification

Personal communication with Manitoba Conservation and Water Stewardship (MCWS) has indicated that the maximum disposal volume of 1000 m³ could be considered for landfill disposal. MMM completed a quantity verification to provide an accurate estimate of the volume of lagoon sludge to be removed and disposed of at the Prairie Green Landfill.

The quantity verification was achieved through a volumetric survey conducted by MMM staff on October 16, 2015, using survey grade GPS and a survey rod. The wastewater elevation was established to a geodetic elevation, then the top and bottom of the lagoon sludge was measured against the water elevation. The perimeter of the sludge survey was approximately 7 m from the edge of the lagoon water and sludge boundary. Based on the site survey, MMM completed volume calculations utilizing the survey coordinates and elevations.

The resulting estimated quantity of the solids material is 289 m³ for both Cell 1 (150 m³) and Cell 2 (138 m³). Due to the nature of estimating the sludge volume, a contingency percentage of 25% is applied for a total of 360 m³ to be removed and disposed of at the landfill.

Therefore, we request approval to allow a one-time landfill disposal of 360 m³ wastewater lagoon solids from the RM of Springfield Regional Lagoon to be deposited in the Prairie Green Landfill.

Solids Suitability for Landfill

The purpose of solids suitability testing is to verify the amount of slumping that will occur to the landfilled lagoon material. The Prairie Green Landfill (EAL #2177E RRRR) requires the material to meet specific criteria so as to reduce slumping. The verification process includes laboratory analysis for percent moisture, percent solids, total and volatile solids and particle size analysis. In-

field verification was accomplished by slump testing and density testing the sludge material. The material to be landfilled cannot slump more than 150 mm as per the EAL #2177E RRRR during the slump test.

The sludge material was collected from the lagoon by a tractor with a back hoe (Photo 3). The sludge was then shovelled directly from the back hoe bucket into plastic pails (Photo 4). A total of six samples were collected in this manner, three from Cell 1 and three from Cell 2.

The slump test was performed by MMM staff on October 21, 2015, in accordance with CSA Standard A23.2-5C “test methods and standard practices for concrete.” The apparatus for sampling included a metal cone, straight steel tamping rod and plywood for a base. The sludge material was added to the large end of the cone and tamped. The cone was then inverted onto the plywood and removed. The slump measurement was taken using a tape measure to measure the difference between the top of the sludge material and the top of the metal cone. (Photo 5)

The density testing of the material was completed using a 9.22 L plastic container with an empty mass of 240 grams. The sludge material was added to the container until it filled it completely. The container and material was then placed on a scale and its weight recorded (Photo 6). The results of the slump and density tests are summarized below in Table 1:

Table 1. In-field Slump Test and Density Test Results

Sample ID	Slump test (mm)	Density (kg/m)
Cell East 1	40	1,066
Cell East 2	75	1,059
Cell East 3	125	1,408
Cell East Average	80	1,178
Cell West 1	0	1,463
Cell West 2	130*	1,245
Cell West 3	140*	1,480
Cell West Average	90	1,396

Note: * This sample was observed to be primarily coarse sand material.

Based on the in-field testing of both lagoon cells, the material meets the Prairie Green Landfill EAL #2177E RRRR criteria by having not slumped greater than 150 mm.

Nutrient and Metal Profile

The purpose of conducting an analysis for nutrients and metals is to provide a characterization of the sludge material to determine the potential loss of beneficial use through the recycling of these nutrients in land application programs. The Prairie Green Landfill EAL #2177E RRRR does not include criteria for nutrients or metals of lagoon solids origin. The samples were collected as part of the process described in the above section, "Solids Suitability for Landfill." One sample from each lagoon cell was submitted to ALS Laboratory, a CALA accredited laboratory, for an analysis of Total Kjeldahl Nitrogen (TKN), ammonia, nitrate, nitrite, phosphorous, metals including hot water boron and mercury, total and volatile solids, moisture, salinity and particle size analysis (Certificate of Analysis is attached). A further two samples from each cell were submitted for total and volatile solids and moisture only. The results of the analysis are summarized in Table 2, Table 3 and Table 4 appended to this letter.

The estimated loss of organic nitrogen is approximately 6.8 kg/tonne from the east cell and 1.7 kg/tonne from the west cell. This provides an estimated removal of organic nitrogen of 1,499 kg and 407 kg from the east cell and west cell, respectively.

The estimated loss of total phosphorous is approximately 2.11 kg/tonne from the east cell and 0.99 kg/tonne from the west cell. This provides an estimated removal of total phosphorous of 466 kg and 238 kg from east cell and west cell, respectively. The estimated loss of available phosphate-P is approximately 0.06 kg/tonne from the east cell and 0.016 kg/tonne from the west cell. This provides an estimated removal of plant available phosphorous of 13 kg and 4 kg from east cell and west cell, respectively.

One sample from each cell was analyzed for metals (Table 3, attached). The results indicate an elevated concentration of arsenic, cadmium, copper, lead, molybdenum, nickel, selenium and zinc when compared against Canadian Council of Ministers of the Environment (CCME) - Environmental Quality Guidelines for coarse grain soil, industrial land use and groundwater protection (lined cell). Within the lagoon cell and/or the lined confines of the landfill these elevated concentrations do not pose a contamination concern, however, these elevated concentrations, specifically copper and zinc, would not permit this solids material to be land applied to agricultural fields. This is due to the metals concentrations exceeding the cumulative weight per hectare in the soil for a typical MCWS Environmental Act Licence.

Based on the estimated total volume (360 m³), there is a total of 1,906 kg of organic nitrogen and total of 704 kg of total phosphorous that is being removed from the system and disposed of. However, the concentrations of metals in this material demonstrate that the material is not appropriate for land application and therefore the appropriate management for this material is disposal in a licenced landfill facility.

Salinity

A detailed salinity analysis was completed for each lagoon cell (Table 5, attached). The conductivity was 5.69 dS/m and 4.6 dS/m for the east and west cells, respectively. The results also indicated elevated concentrations of sulfur and chloride. Due to the material being landfilled, these results do not pose a concern.

Schedule

The RM of Springfield would like to have this project completed promptly, prior to the winter freeze-up. The removal of the sludge material would likely begin as soon as approval from MCWS has been received.

Letter of Acceptance


MMM was provided with a Letter of Acceptance from the Prairie Green Landfill on November 9, 2015. The letter, signed by Mr. Barry Blue, Landfill Operations Manager with Progressive Waste Solutions, states the landfill will accept sludge waste but it must meet slump test criteria of 150 mm. The letter of acceptance is attached.

Conclusions

MMM was retained by the RM of Springfield to complete a Notice of Alteration for EAL #2634 for a one-time landfill disposal of lagoon solids. The results of the slump testing indicated that the material was acceptable for the Prairie Green Landfill and laboratory analyses indicated that the material was unsuitable for land application due to elevated concentrations of metals and high percent solids. Therefore we request approval from MCWS to allow for the disposal of 360 m³ of lagoon solids to Prairie Green Landfill as soon as possible so the RM of Springfield can begin removal and transfer of the solids.


Yours truly,

MMM Group Limited



Brian Moons, B.Sc.
Biologist
Dated: November 12, 2015

Reviewed by:



Darren Keam, M.Sc., P.Ag.
Project Manager
Dated: November 12, 2015

cc.: Mr. Rob Boswick (MCWS)
Mr. Greg Elson (RM of Springfield)

Attachments
BM/tc



Photo 1. Truck unloading area at the west cell.



Photo 2. Truck unloading area at the east cell.



Date Taken: October 21, 2015

Client: RM of Springfield

Taken by: DKeam

Project No.: 3315446

Location: RM of Springfield



Photo 3. Sampling lagoon solids from west cell with back hoe.



Photo 4. Shovelling solids from back hoe into sampling pail.



Date Taken: October 21, 2015

Client: RM of Springfield

Taken by: DKeam

Location: RM of Springfield


Project No.: 3315446

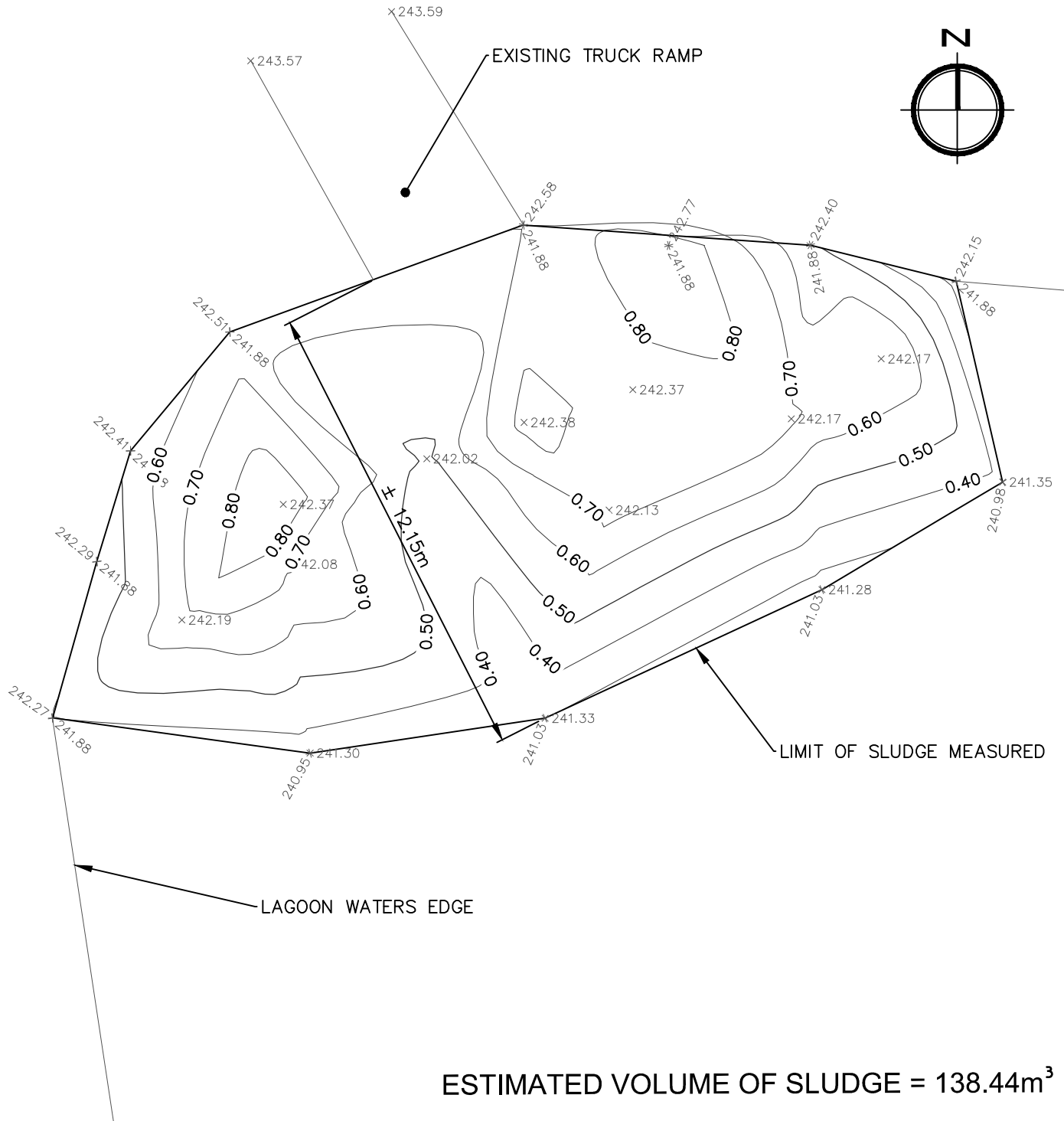
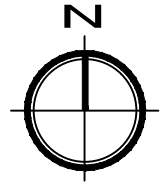


Photo 5. Slump testing the lagoon solids.



Photo 6. Density testing the lagoon solids.

	Date Taken: October 21, 2015	Client: RM of Springfield
	Taken by: DKeam	Location: RM of Springfield
	Project No.: 3315446	



ESTIMATED VOLUME OF SLUDGE = 138.44m³

NOTE:

1. BENCH MARK ELEVATION 241.877m – WATER LEVEL – OCT.16,2015
2. ELEVATION ERROR +/- 2cm (Trimble R8 GPS)
3. HORIZONTAL ERROR BASED ON OBSERVED DISTANCE +/- 1m

NOTE:

These design documents are prepared solely for the use by the party with whom the design professional has entered into a contract and there are no representations of any kind made by the design professional to any party with whom the design professional has not entered into a contract.

METRIC

WHOLE NUMBERS INDICATE MILLIMETRES
DECIMALIZED NUMBERS INDICATE METRES

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SPRINGFIELD LAGOON

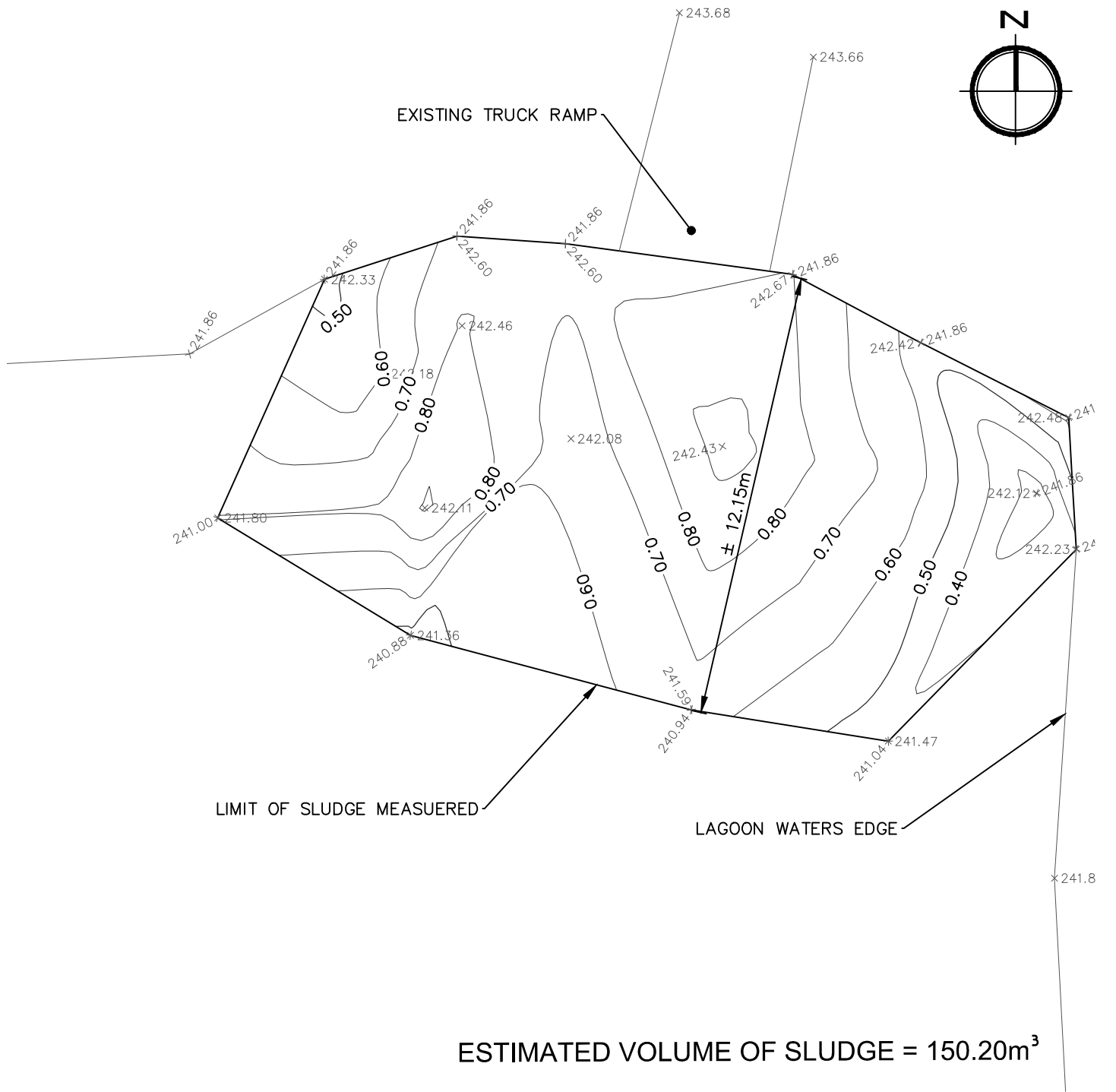
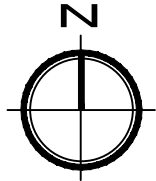
CELL 2 EAST
VOLUME

SCALE: NTS

DATE: 27 OCT 2015

DWG. No.

SK-02



NOTE:

1. BENCH MARK ELEVATION 241.877m – WATER LEVEL – OCT.16,2015
2. ELEVATION ERROR +/- 2cm (Trimble R8 GPS)
3. HORIZONTAL ERROR BASED ON OBSERVED DISTANCE +/- 1m

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SPRINGFIELD LAGOON

CELL 1 WEST
VOLUME

SCALE: NTS

DATE: 27 OCT 2015

DWG. No. SK-01

Table 2. Results of Nutrient Analyses for the East and West Cell of the RM of Springfield Regional Lago

Analyte	Units	Sample ID	Cell East 1		Cell West 1		
		Detection Limit	Soil	kg/tonne	Soil	kg/tonne	
Total Kjeldahl Nitrogen	%	0.02	0.74		0.184		
	mg/kg		7400	7.40	1840	1.84	
Available Ammonium-N		24	614	0.614	148 ¹	0.148	
Available Nitrate-N		2	<2.0	-	<2.0	-	
Nitrate+Nitrite-N		2	<4.0 ²	-	<2.0	-	
Nitrate-N		2	<4.0 ²	-	<2.0	-	
Nitrite-N		0.4	<0.80 ²	-	0.47	-	
Organic Nitrogen					6.8	1.7	
Available Phosphate-P		1	60	0.06	16.2	0.0162	
Total Phosphorous				2110	2.11	990	0.99
Loss of Beneficial Use Calculations							
Mean Density (in-field)	kg/m3		1,178		1,396		
Contingency Disposal Volumes	m3		187.5		172.5		
Disposed Organic Nitrogen	kg		1,499		407		
Disposed Available Phosphate-P	Kg		13		4		
Disposed Total Phosphorous	kg		466		238		

¹Detection Limit Raised: Dilution required due to high concentration of test analyte(s)

²Detection Limit adjusted due to sample matrix effects

Table 3. Results of Metals Analyses for the East and West Cell of the RM of Springfield Regional Lagoon.

Analyte	Units	Sample ID	Cell East 1	Cell West 1	Guidelines ²
		Detection Limit	Soil	Soil	
Antimony (Sb)	mg/k g	0.1	5.36	33.6	40
Arsenic (As)		0.1	8.86	209	12
Barium (Ba)		0.5	290	87.5	2000
Beryllium (Be)		0.1	0.18	<0.10	8
Boron (B), Hot Water Ext. Available		0.8	9.931 ¹	3.25 ¹	-
Cadmium (Cd)		0.02	4.02	83.2	22
Chromium (Cr)		1	38.4	45.4	87
Cobalt (Co)		0.02	8.67	69.7	300
Copper (Cu)		1	1020	32500	91
Lead (Pb)		0.2	59.8	1050	600
Mercury (Hg)		0.05	0.075	0.91	50
Molybdenum (Mo)		0.02	21.7	126	40
Nickel (Ni)		0.5	102	1150	50
Selenium (Se)		0.5	1.41	32.4	2.9
Silver (Ag)		0.1	1.14	31	40
Thallium (Tl)		0.1	<0.10	0.62	1
Tin (Sn)		5	8.6	49	300
Uranium (U)		0.02	1.18	0.738	300
Vanadium (V)		0.5	17.5	15	130
Zinc (Zn)		10	1030	27600	360

¹Detection Limit adjusted due to sample matrix effects

²Federal CCME Canadian Environmental Quality Guidelines (July 2012), Coarse Soil, Industrial, Groundwater Protected

Above guideline

Table 4. Physical Properties of the Solids Material from the East and West Cell of the RM of Springfield Regional Lagoon.

Analyte	Units	Sample ID	Cell East 1	Cell East 2	Cell East 3	Cell West 1	Cell West 2	Cell West 3
		Detection Limit	Soil	Soil	Soil	Soil	Soil	Soil
% Moisture	%	0.1	46.1	54.8	33.2	21.3	6.1	11.6
% Saturation		1	135	-	-	51.2	-	-
Total Volatile Solids (dry basis)		0.1	26.8*	30*	10.9*	5.56*	2.44*	2.47*
Total Solids		0.1	54.2*	46.9*	67.8*	77.6*	94.1*	87.6*
% Sand (2.0mm - 0.05mm)		0.1	61.4	-	-	82.8	-	-
% Silt (0.05mm - 2um)		0.1	32.9	-	-	14.1	-	-
% Clay (<2um)		0.1	5.68	-	-	3.08	-	-
Texture	-	-	Sandy loam	-	-	Loamy sand	-	-

*Manure sample analysis

Table 5. Results of Salinity Analyses for the East and West Cell of the RM of Springfield Regional Lagoon.

Analyte	Units	Sample ID	Cell East 1	Cell West 1
		Detection Limit	Soil	Soil
SAR	SAR	0.1	9.26	2.18
Calcium (Ca)	mg/L	25	92 ¹	417 ¹
Chloride (Cl)		50	1680 ¹	564 ¹
Magnesium (Mg)		25	63 ¹	126 ¹
Potassium (K)		25	80 ¹	55 ¹
Sodium (Na)		25	470 ¹	198 ¹
Sulfur (as SO4)		25	1800 ³	2200 ³
Calcium (Ca)		mg/kg	13	124 ¹
Chloride (Cl)	26		2270 ¹	289 ¹
Magnesium (Mg)	13		85 ¹	64 ¹
Potassium (K)	13		108 ¹	28 ¹
Sodium (Na)	13		635 ¹	101 ¹
Sulfur (as SO4)	13		2430 ³	1120 ³
Conductivity Sat. Paste	dS m-1	0.1	5.69	4.6
pH in Saturated Paste	pH	0.1	7.09	6.8

¹Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity



To whom it may concern:

Please be advised that Prairie Green IWMF, located in the R.M. of Rosser, is agreeable to accepting sludge waste from the RM of Springfield. The waste must meet slump test criteria of not less than 150mm as per CSA test method A23.2-5C. Prior to disposal, approval must be granted from Manitoba Conservation and Water Stewardship in accordance to Environment Act License 2177E RRRR and the conditions contained within said license.

Sincerely,

A handwritten signature in black ink, appearing to read "B. Blue", with a long horizontal flourish extending to the right.

**Barry Blue
Landfill Operations Manager**