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May 31, 2019

Asit Dey, P. Eng.
Environmental Engineer
Department of Sustainable Development
Environmental Approvals Branch
Government of Manitoba
1007 Century Street
Winnipeg, MB
R3H 0W4

Re: Glenway Holding Co. Ltd. – Domestic Wastewater Treatment Lagoon

Dear Mr. Dey,

In fulfilment of the requirements for testing on the recompacted clay liner I have attached the test results for the selected samples submitted for hydraulic conductivity testing. Based on these favourable results and previous completion of the appurtenances associated with erosion protection and piping, construction is considered to be complete and use of the facility is permissible pending your departments approval.

I trust this will provide the necessary information to permit use of the new cell, however please feel free to contact me if you have any further questions or concerns.

Sincerely Submitted;

South-Man Engineering

Per,

Peter Grieger, P. Eng.





Quality Engineering | Valued Relationships

November 20, 2018

Our File No. 1000-012-01

Paul Bevel
H. Manalo Consulting
1402 Notre Dame Ave.
Winnipeg, Manitoba.
R3E 3G5

RE Lab Testing Results for MTR-892 –Hydraulic Conductivity Results

Please see the attached Hydraulic Conductivity report. One Shelby tube sample was dropped off to TREK on November 6, 2018. This report contains the hydraulic conductivity test results for ST #4 using a flexible wall permeameter following ASTM D5084-16.

The test report for the sample are attached showing the calculated hydraulic conductivity values corrected to 20°C are as follows:

Sample #ST4 5.14E-11 m/s (5.14 x 10⁻⁹ cm/s)

The services undertaken by TREK on this assignment constitutes testing services only and engineering evaluation or interpretation has not been undertaken, but is available upon request

If you have any questions or require additional information or clarifications, please contact Angela at 204.792.8458.

Kind Regards,

TREK Geotechnical

Review Control:

<i>Prepared By:</i> AFK	<i>Reviewed By:</i> AFK	<i>Checked By:</i> NJF
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Project No. 1000-012-01
Client H. Manalo
Project 2018 General Testing

Test Hole MTR-892
Trek Sample # ST#4
Depth (m) N/A
Sample Date N/A
Test Date November 6, 2018 to November 20, 2018
Technician AFK

Specimen Details

Visual Classification Clay, silty, trace sand, trace to some gravel (< 5mm diam.), grey brown, moist, firm, intermediate to high plasticity.
Comments The specific gravity of the soil was assumed to be 2.80.

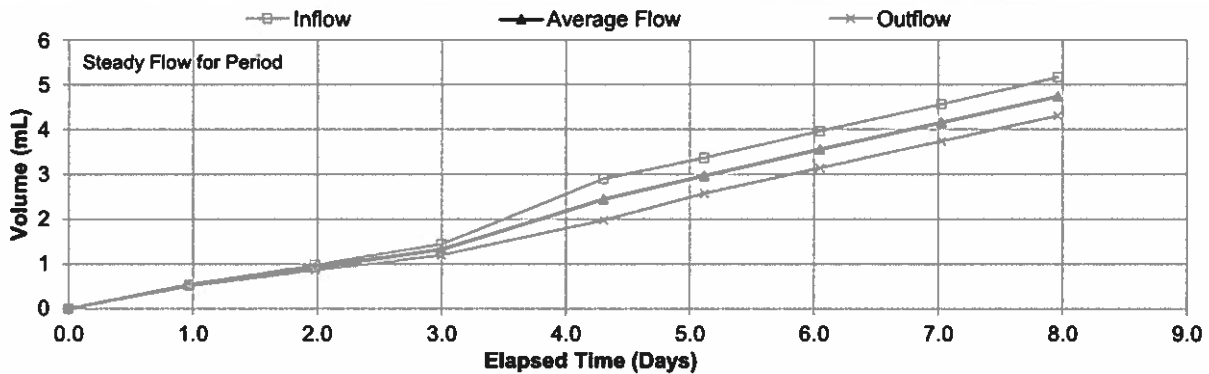
Index Testing

Liquid Limit Not Requested
Plastic Limit Not Requested
Plasticity Index Not Requested
Clay Content (%) Not Requested

Test Details

Permeant Distilled, de-aired water
Method Constant Head
Cell Pressure 135.7 kPa
Influent Pressure 108.1 kPa
Effluent Pressure 84.7 kPa
Gradient 28.10

Permeation Graph



Steady Flow Permeation Data

Time Increment (Days)	Elapsed Time (Days)	Flow (Q)		Inflow / Outflow Ratio	Average Flow (mL)	Temperature Correction	Corrected Hydraulic Conductivity, k_{20} (m/s)
		Influent (mL)	Effluent (mL)				
0.81	5.12	3.36	2.57	0.78	0.53	1.02	5.36E-11
0.93	6.05	3.96	3.14	1.05	0.59	1.02	5.19E-11
0.98	7.03	4.56	3.74	1.00	0.60	0.99	4.98E-11
0.93	7.96	5.16	4.30	1.07	0.58	0.99	5.01E-11

Average Temperature Corrected Hydraulic Conductivity, k_{20} (m/s) 5.14E-11 (5.14x10⁻⁹ cm/s)

Consolidation Data

	Average Height (m)	Average Diameter (m)	Moisture Content (%)	Dry Density (kN/m ³)	Degree of Saturation (%)	Cell Pressure	Back Pressure
Initial	0.0849	0.0704	45.9	11.5	92.7	120.3	85.0
Final	0.0849	0.0706	56.3	10.8	101.4	120.3	85.0



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November 27, 2018

Our File No. 1000-012-01

Paul Bevel
H. Manalo Consulting
1402 Notre Dame Ave.
Winnipeg, Manitoba.
R3E 3G5

RE Lab Testing Results for MTR-892 –Hydraulic Conductivity Results

Please see the attached Hydraulic Conductivity report. One Shelby tube sample was dropped off to TREK on November 1, 2018. This report contains the hydraulic conductivity test results for ST #3 using a flexible wall permeameter following ASTM D5084-16.

The test report for the sample are attached showing the calculated hydraulic conductivity values corrected to 20°C are as follows:

Sample #ST3 2.18E-11 m/s (2.18 x 10⁻⁹ cm/s)

The services undertaken by TREK on this assignment constitutes testing services only and engineering evaluation or interpretation has not been undertaken, but is available upon request

If you have any questions or require additional information or clarifications, please contact Angela at 204.792.8458.

Kind Regards,

TREK Geotechnical

Review Control:

<i>Prepared By:</i> AFK	<i>Reviewed By:</i> AFK	<i>Checked By:</i> NJF
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Project No. 1000-013-01
Client H. Manalo
Project MTR-892

Test Hole TH-3
Trek Sample # ST-3
Depth (m) N/A
Sample Date N/A
Test Date November 1, 2018 to November 26, 2018
Technician BMH

Specimen Details

Visual Clay, silty, trace sand, trace gravel (< 5mm diam.), grey, moist, firm, high plasticity.

Classification

Comments The specific gravity of the soil was assumed to be 2.80.

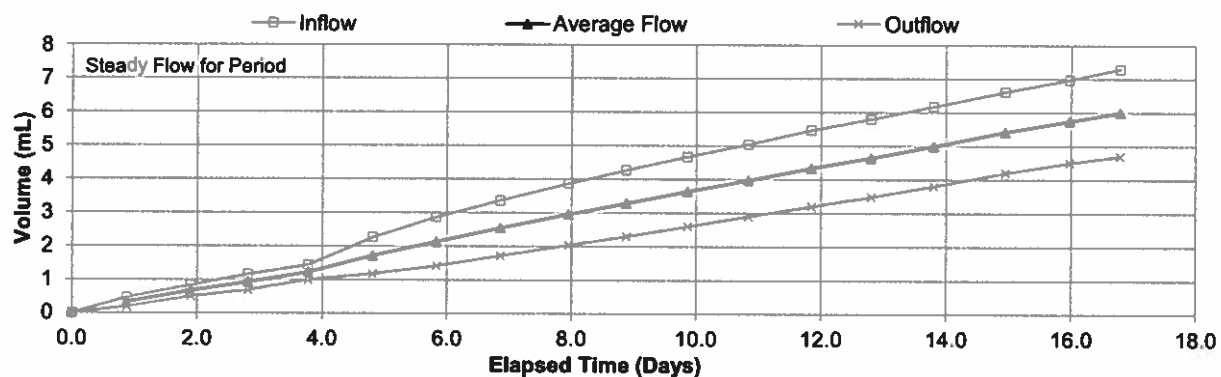
Index Testing

Liquid Limit Not Requested
Plastic Limit Not Requested
Plasticity Index Not Requested
Clay Content (%) Not Requested

Test Details

Permeant Distilled, de-aired water
Method Constant Head
Cell Pressure 134.4 kPa
Influent Pressure 116.7 kPa
Effluent Pressure 84.4 kPa
Gradient 42.67

Permeation Graph



Steady Flow Permeation Data

Time Increment (Days)	Elapsed Time (Days)	Flow (Q)		Inflow / Outflow Ratio	Average Flow (mL)	Temperature Correction	Corrected Hydraulic Conductivity, k_{20} (m/s)
		Influent (mL)	Effluent (mL)				
0.95	12.80	5.80	3.48	1.21	0.31	0.99	2.08E-11
1.00	13.80	6.18	3.80	1.19	0.35	1.00	2.23E-11
1.15	14.95	6.62	4.20	1.10	0.42	0.99	2.34E-11
1.03	15.98	6.98	4.50	1.20	0.33	1.00	2.07E-11

Average Temperature Corrected Hydraulic Conductivity, k_{20} (m/s) 2.18E-11 (2.18x10⁻⁹ cm/s)

Consolidation Data

	Average Height (m)	Average Diameter (m)	Moisture Content (%)	Dry Density (kN/m ³)	Degree of Saturation (%)	Cell Pressure	Back Pressure
Initial	0.0784	0.0708	43.2	12.1	95.3	120.0	85.0
Final	0.0788	0.0708	47.2	11.9	101.0	120.0	85.0