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September 8, 2020

Project No. 20-142-01

Miller Environmental Corporation
P.O. Box 279
St. Jean Baptiste, MB R0G 2B0

ATTENTION: Chris Bell

RE: Hydraulic Conductivity Test Results, RC3 Repository Construction, NE-02-03-1E,
South of St. Jean Baptiste, Manitoba

ENG-TECH Consulting Limited (ENG-TECH) collected a total of six (6) Shelby tube samples from the above project on August 17, 2020. The Shelby tube samples (identified as S1 to S6) were extracted on August 18, 2020 at the ENG-TECH laboratory. The soil samples were prepared for testing in accordance with ASTM D5084-16a, *Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials using a Flexible Wall Permeameter*.

Three (3) hydraulic conductivity tests were performed on samples S3, S5 and S6, which were selected by Manitoba Conservation. The final hydraulic conductivity values (k_{20}) of these samples ranged from 4.13×10^{-9} to 8.70×10^{-9} cm/sec. The hydraulic conductivity test data is summarized in Table 1, while the graphical representations of the hydraulic conductivity versus elapsed time are shown in Charts 1 to 3. Photographs of the sampling and samples are attached. Shelby tube sample locations are presented on Figure 1.

ENG-TECH trusts this is all the information you require. If you have any questions or require additional information, please contact the undersigned.

Sincerely,
ENG-TECH Consulting Limited

Walter Holowka, C.E.T., N.C.S.O.
Senior Geoenvironmental Technologist

Clark Hryhoruk, M.Sc., P.Eng.
President

CDH/wgh

Attachments

Table 1 – Hydraulic Conductivity Test Data RC3 Repository Construction
Chart 1 – Hydraulic Conductivity Versus Elapsed Time RC3 Repository Construction: Sample S3
Chart 2 – Hydraulic Conductivity Versus Elapsed Time RC3 Repository Construction: Sample S5
Chart 3 – Hydraulic Conductivity Versus Elapsed Time RC3 Repository Construction: Sample S6
Photographs (1 to 5)
Figure 1 – Shelby Tube Sample Locations

**TABLE 1
HYDRAULIC CONDUCTIVITY TEST DATA
RC3 REPOSITORY CONSTRUCTION**

SAMPLE ID	S3	S5	S6
INITIAL VALUES			
ENG-TECH Reference No.	20-142-1-3	20-142-1-4	20-142-1-5
Length of Sample in Tube (cm)	~60	~60	~60
Length (cm)	5.19	6.62	4.78
Diameter (cm)	7.10	7.12	7.07
Area (cm ²)	39.6	39.8	39.2
Volume (cm ³)	205.4	263.4	187.6
Water Content (%)	49.8	36.6	31.2
Bulk Dry Density (kg/m ³)	1158	1345	1469
Specific Gravity (G _s) (assumed)	2.70	2.70	2.70
Void Ratio	1.332	1.008	0.838
Degree of Saturation (%)	~100	~100	~100
FINAL VALUES			
Length (cm)	5.24	6.70	4.93
Diameter (cm)	7.14	7.28	7.29
Area (cm ²)	40.0	41.6	41.7
Volume (cm ³)	209.7	278.7	205.7
Water Content (%)	50.5	41.4	36.7
Bulk Dry Density (kg/m ³)	1154	1277	1359
Specific Gravity (G _s) (assumed)	2.70	2.70	2.70
Void Ratio	1.339	1.115	0.986
Degree of Saturation (%)	~100	~100	~100
CONSOLIDATION PHASE			
Confining Pressure (kPa)	103.4	103.4	103.4
Pore Water Pressure (kPa)	82.7	82.7	82.7
Effective Stress (kPa)	20.7	20.7	20.7
PERMEATION PHASE			
Confining Pressure (kPa)	103.4	103.4	103.4
Pore Water Pressure (kPa)	82.7	82.7	82.7
Effective Stress (kPa)	20.7	20.7	20.7
Hydraulic Gradient	15.4	15.4	15.4
Permeant Fluid	Potable Tap Water		
HYDRAULIC CONDUCTIVITY AT TEST TEMPERATURE: 22°C (cm/sec)	4.33 x 10 ⁻⁹	9.13 x 10 ⁻⁹	5.24 x 10 ⁻⁹
HYDRAULIC CONDUCTIVITY TEMPERATURE CORRECTED TO 20°C (K₂₀) (cm/sec)	4.13 x 10 ⁻⁹	8.70 x 10 ⁻⁹	4.99 x 10 ⁻⁹



Chart 1: Hydraulic Conductivity Versus Elapsed Time
Miller Environmental RC3 Repository Cell: Sample S3

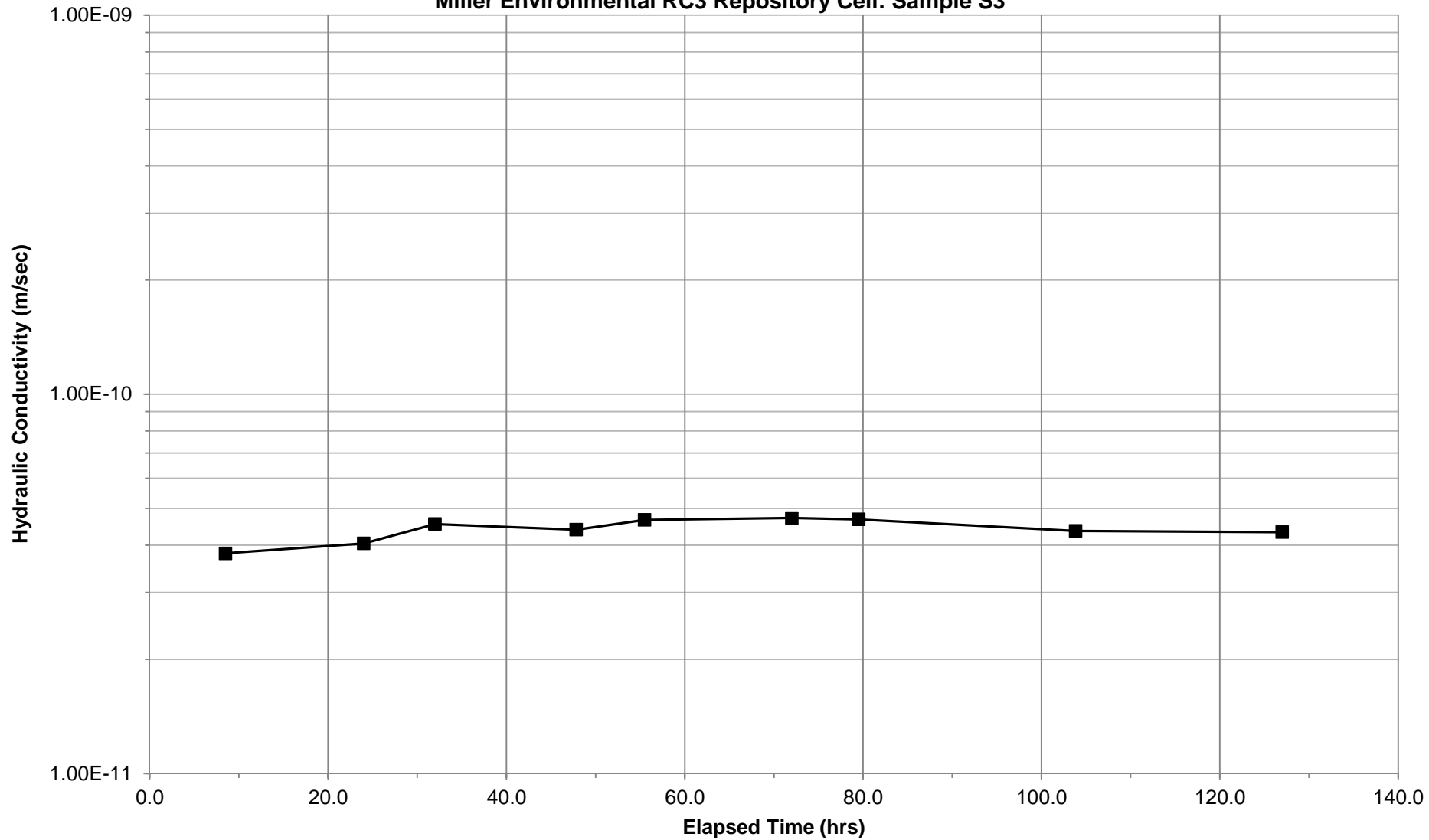


Chart 2: Hydraulic Conductivity Versus Elapsed Time
Miller Environmental RC3 Repository Cell: Sample S5

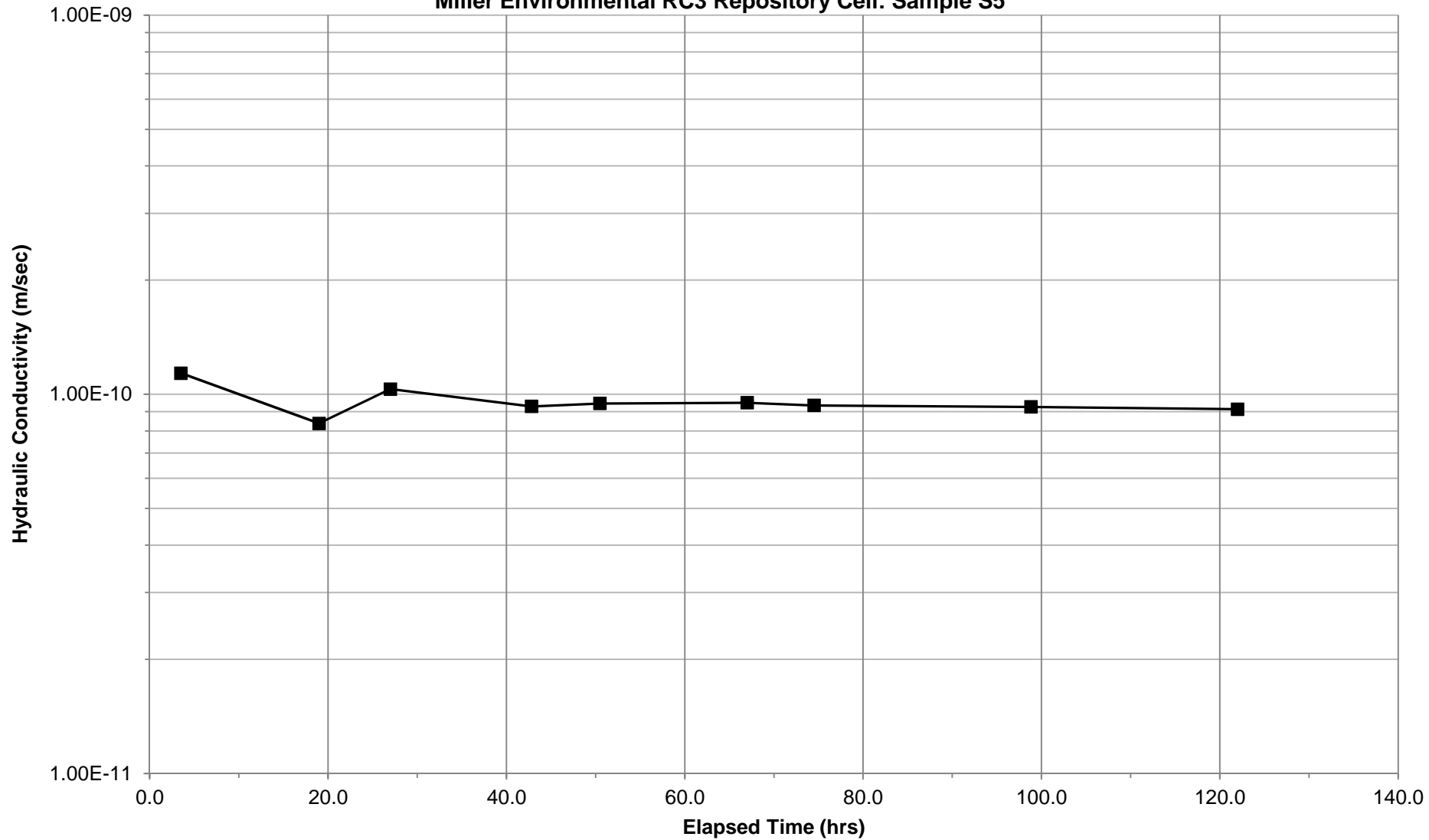
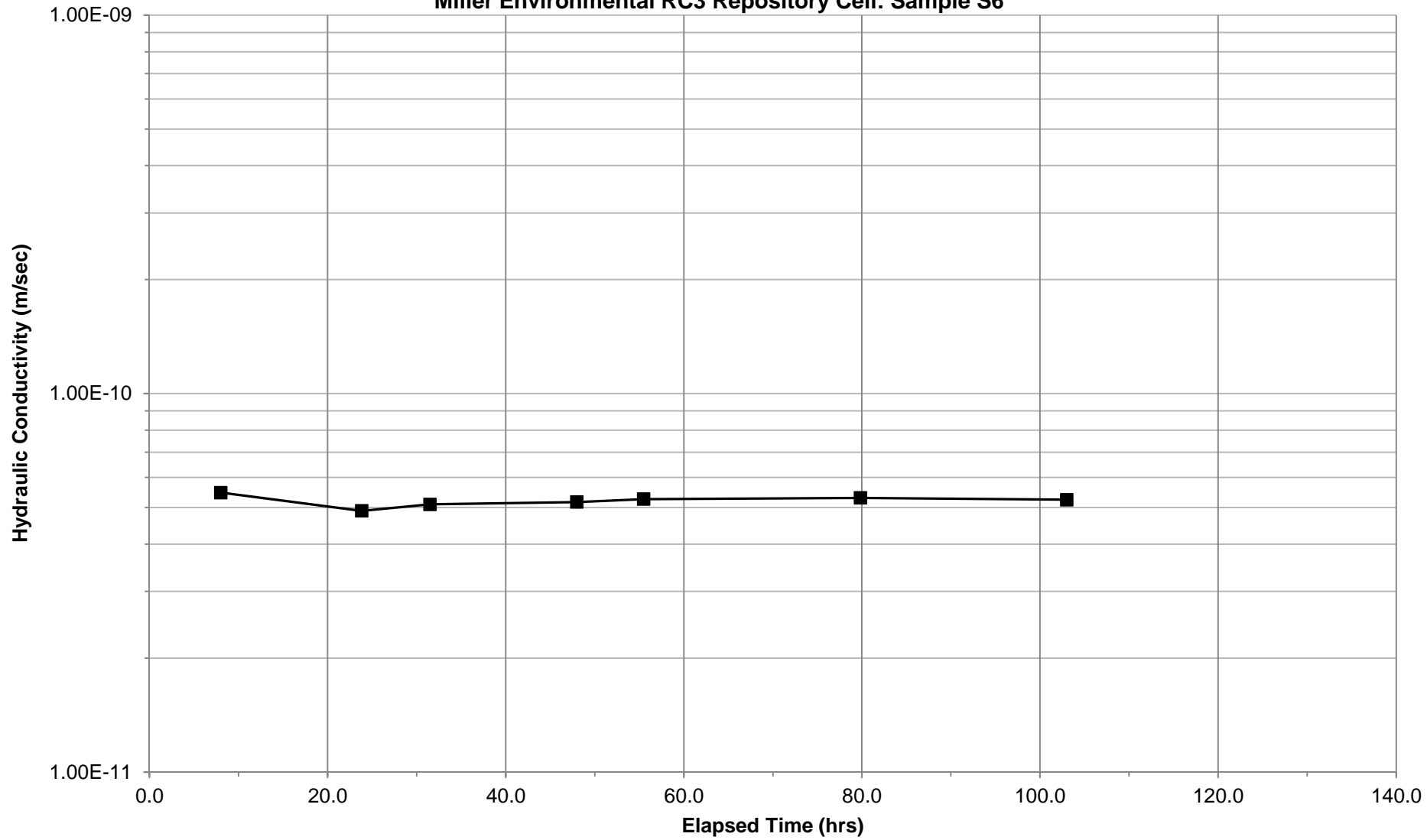


Chart 3: Hydraulic Conductivity Versus Elapsed Time
Miller Environmental RC3 Repository Cell: Sample S6





PHOTOGRAPH #1: View of the cell as seen facing east from the west berm.



PHOTOGRAPH #2: Collecting the Shelby tube sample at location S6.



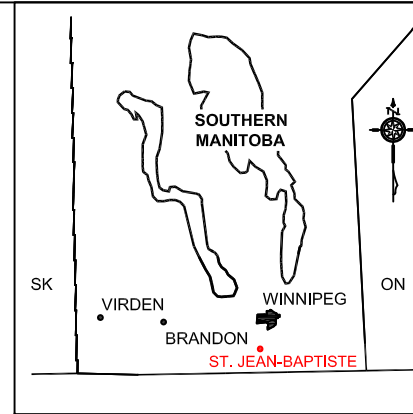
PHOTOGRAPH #3: Sample S3 after hydraulic conductivity testing.



PHOTOGRAPH #4: Sample S5 after hydraulic conductivity testing.

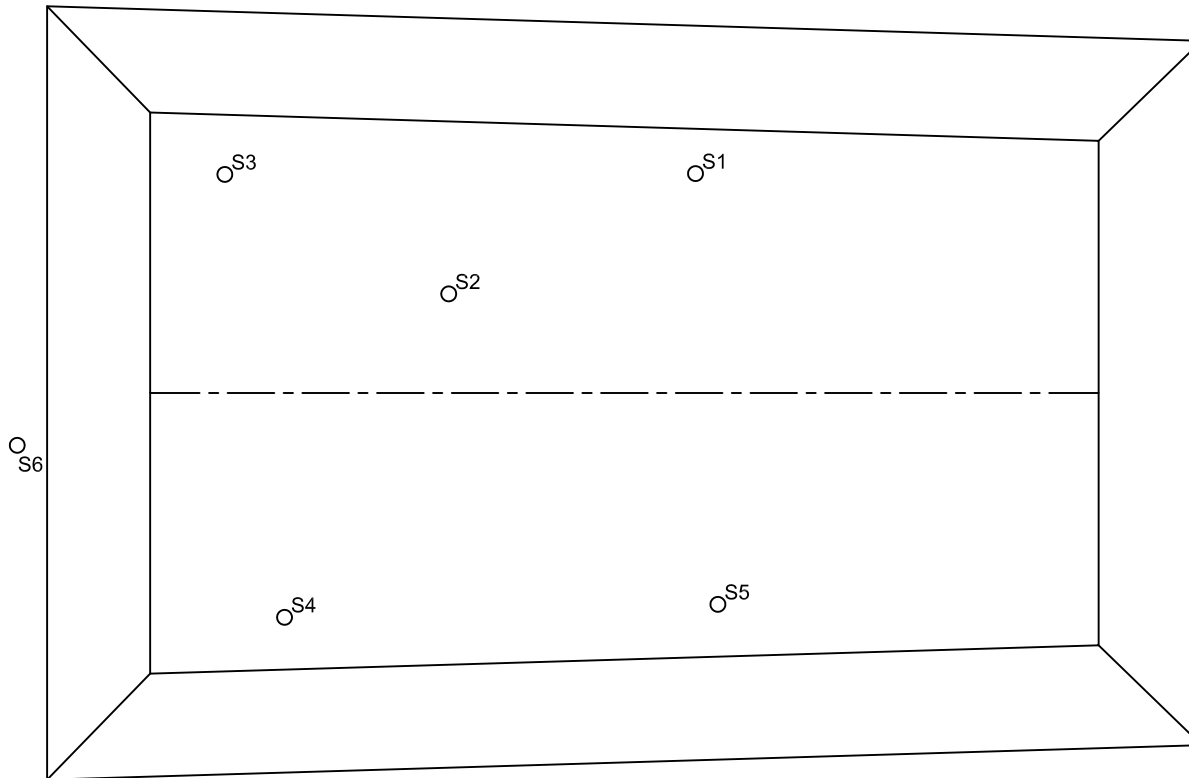


PHOTOGRAPH #5: Sample S6 after hydraulic conductivity testing.



LEGEND

○ S1 SHELBY TUBE SAMPLE LOCATION



NO.	DATE	ISSUE / REVISION
0	SEP 2020	REPORT



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ENG. STAMP:



CLIENT:
MILLER ENVIRONMENTAL CORPORATION

PROJECT:
RC3 REPOSITORY CONSTRUCTION
HYDRAULIC CONDUCTIVITY
ST. JEAN BAPTISTE, MANITOBA

DWG DESCRIPTION:
SHELBY TUBE SAMPLE LOCATIONS

SCALE:
1:1,000

DRAWN BY: WGH	DATE: SEPTEMBER 2020
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FILE No.: 20-142-01	CLIENT DWG/FIG. No.:
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ENG-TECH DWG/FIG. No.: 1	NO.: 0
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