APPENDIX F – SLUDGE SURVEY – NATECH ENVIRONMENTAL SERVICES INC. – NOVEMBER 7, 2014

SLUDGE SAMPLING RESULTS

NATECH Environmental Services Inc.
2492 Route 640, Hanwell, NB E3E 2C2, Canada ph.: (506) 455-1085, fax: (506) 455-1088

November 7, 2014

Mr. André Léger, P.Eng., Project Manager
Public Works and Government Services Canada
1045 Main Street, Unit 100
Moncton, N.B.
E1C 1H1

Re: **Springhill Institution - Sludge Survey**

Dear André:

As requested, we performed a bathymetric survey of the Springhill Institution Lagoon System on October 21, 2014. The purpose of the investigation was to identify the quantity of sludge present and the location of any sludge deposits.

The Springhill Institution Lagoon System contains three individual lagoons, referred to as Cells No. 1, 2 and 3 according to the latest available drawing provided by you (Drawing No. 1 from Porter Dillon Consulting Engineers, dated July 1994). The reference used to tie in all the elevations surveyed was Manhole 3B. The top of this manhole has an elevation of 145.50 m based on a former drawing (Drawing No. HC-2(R) from Acres International Ltd., dated October 1991). Based on this reference elevation, the water level surveyed on October 21, 2014 was at 144.07 m geodetic for Cell 1, 144.06 m for Cell 2 and 144.06 m for Cell 3.

Sludge depths were determined using a boat equipped with a GPS and a 200 kHz echo sounder. Approximately 6,450 valid survey points were obtained. A digital terrain model was employed to calculate the sludge volume in each cell, based on the individual survey points. The amount of sludge accumulated was calculated by determining the difference between the surveyed sludge/water interface and the design lagoon bottom shape.

Design drawing No. 1 from Porter Dillon Consulting Engineers (1994) indicates that the lagoon bottom for Cell 1 should be at 141.50 m geodetic. Drawing No. HC-2(R) from Acres International Ltd. (1991) indicates that the bottom should 142.50 m geodetic in Cell 2, and at 141.40 m geodetic in Cell 3. Manual probing was used at several locations in order to confirm the elevations of the bottom of each cell. The observed average bottom elevations were 141.15 m for Cell 1, 142.38 m for Cell 2, and 141.52 m for Cell 3. These elevations differ from the design elevations, but are consistent with the depths measured with the echosounder on the boat. Consequently the observed cell depths were used (instead of the design depths) in the calculation of the total sludge volume.

The attached Figure 1 displays colour coded contour maps of the sludge deposits in each cell observed on October 21, 2014. Photographs of the cells are attached as well. Table 1 details the characteristic elevations and volumes of each cell. The interpolation model shows that approximately 630 m^3 of sludge are present in Cell 1 spread in a thin layer, except for a large deposit near the end of the inlet pipe. There are at the most 640 m^3 of sludge in Cell 2 and 280 m^3 in Cell 3 (a thick layer of duck weed limited the number of reliable measurements on the east side of Cells 2 and 3 and the quantities may be slightly overestimated). Some of the sludge is located in the corners, along the toe of the berms, and in a relatively even layer on the bottom. Sometimes there can be slumped berm material as well. That material would not be easily removable through dredging and we recommend against attempting to dredge Cells No. 1, 2 and 3 at this time.

We trust that this information meets your requirements. Please do not hesitate to call, should you have any questions.

Yours sincerely,

V. Balland

Vincent Balland, M. Sc., P. Eng.

Attachments: 2 figures, 1 table
VB/js
Docs 2014\Springhill Lagoon Survey

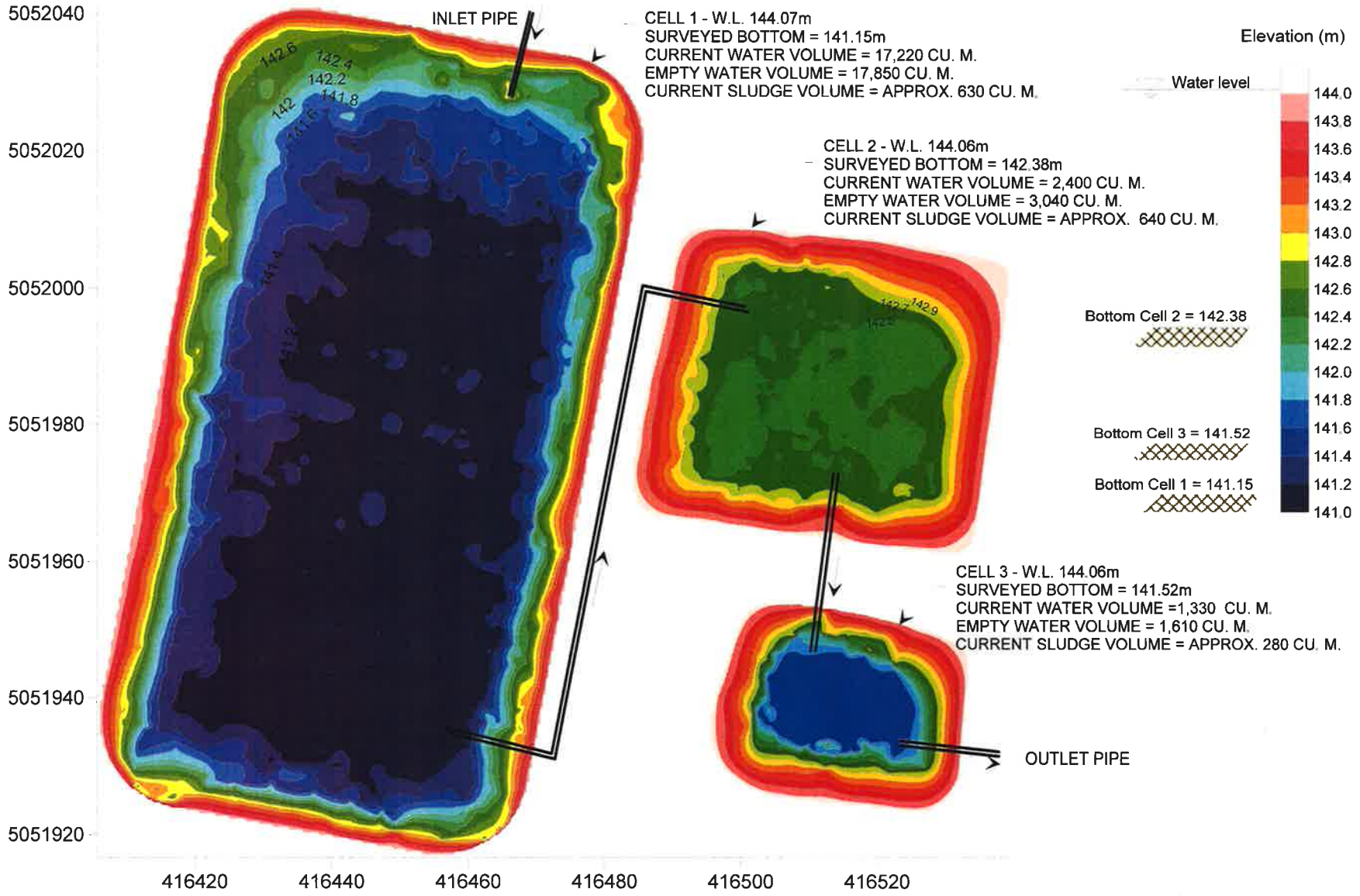
Table 1. Characteristics of the three lagoon cells of the Dorchester Institution

Parameter	Unit	Cell 1	Cell 2	Cell 3
Information from design drawings:				
Design bottom elevation	m	141.50[(1)]	142.50[(2)]	141.40[(2)]
Design water level elevation	m	144.25[(1)]	144.25[(1)]	144.25[(1)]
Calculations based on survey of October 21, 2014:				
Observed bottom elevation based on manual probing [(3)]	m	141.15	142.38	141.52
Surveyed water level[(3)]	m	144.07	144.06	144.06
Empty cell capacity at surveyed water level	m^3	17,850	3,040	1,610
Current water volume	m^3	17,220	2,400	1,330
Sludge volume	**m^3**	**630**	**640**	**280**
Percentage of sludge in cell	%	4	21	17
Cell area at water surface	m^2	7,800	2,200	1,000
Average sludge thickness	**m**	**0.08**	**0.29**	**0.28**

(1) According to Design Drawings No. 1 and No. 2 from Porter Dillon Consulting Engineers, 1994.

(2) According to Design Drawing HC-3 from Acres International Ltd., 1991.

(3) Surveyed elevations referenced to the top of Manhole No. 3B, shown at an elevation of 145.50 m on drawing HC-2(R) from Acres International Ltd., 1991.



SPRINGHILL INSTITUTION LAGOON BATHYMETRIC SURVEY ON OCTOBER 21, 2014	NATECH **Environmental Services Inc.** 2492 Route 640, Hanwell, NB E3A 2C2 Ph.: (506) 455-1085 Fax: (506) 455-1088	DATE: 2014/11/07 UTM NAD83 Coordinates (m)	FILE: SHI-14-01 FIGURE: 1

Lagoon cell No. 1

Lagoon cell No. 2

Lagoon cell No. 3

Springhill Lagoon Survey **Photographs taken on October 21, 2014**	NATECH **Environmental Services Inc.** **2492 Route 640, Hanwell, NB, E3E 2C2** **ph: (506) 455 1085, fax (506) 455 1088**	DATE: 2014/11/07 SCALE: -	FILE: SHI-14-01 FIGURE: Appendix A

Report ID: 298145-IAS
Report Date: 12-Dec-18
Date Received: 04-Dec-18

CERTIFICATE OF ANALYSIS

for

Crandall Engineering Ltd
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Attention: Laura Léger
Project #: 014122
Location: Springhill

Analysis of Samples

RPC Sample ID:			298145-1	298145-2	298145-3	298145-4
Client Sample ID:			C2-1	C2-2	C1-3	C1-4
Date Sampled:			4-Dec-18	4-Dec-18	4-Dec-18	4-Dec-18
Analytes	**Units**	**RL**				
Total Volatile Solids	%	0.1	47.0	43.6	61.2	49.2
Total Solids	%	0.1	0.3	2.5	2.9	3.3

This report relates only to the sample(s) and information provided to the laboratory.

RL = Reporting Limit

Ross Kean
Department Head
Inorganic Analytical Chemistry

CHEMISTRY

Peter Crowhurst
Analytical Chemist
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