The new identity of ***Trow***

July 18, 2011

Patricio Fuentes
Community Government Services
Government of Nunavut
P.O. Box 379
Pond Inlet, NU X0A 0S0

Re: OTT-00020662-A0 Slope Inspection
Waste Water Treatment Facility
Pond Inlet, Nunavut

Dear Mr. Fuentes:

We visited the above site on July 4th and 5th, 2011. The purpose of the visit was to inspect the berms of the Waste Water Treatment Facility. This visit is a result of our review of the Waste Water Treatment Facility undertaken in October 2010 and reported under Project No. OTT-00020662-A0 dated January 21, 2011. During the visit of October 2010, the Hamlet of Pond Inlet reported that in their opinion the north berm of the Waste Water Treatment Facility was sliding since frequent settlements of the berm were observed by the Hamlet requiring increased maintenance of the roadway. Since at that time the site was snow covered, it was not possible to examine the berm slopes. It was recommended that the slopes should be examined in 2011 after the snow melt.

Background Information

The Wastewater Treatment Facility in Pond Inlet comprises of an irregularly shaped lagoon with overall equivalent dimensions of 300 m x 150 m.

It is understood that the lagoon was built around 1993 and has experienced progressive problems since approximately 1995. The lagoon was rehabilitated in 2003/2004.

Available information indicates that the lagoon is located in a low spot with higher ground on the east, south and west sides. The site was previously a natural pond prior to the construction of the lagoon. The pond had an overflow to the north which drained to the Ocean (Figure 1). It is noted that prior to the 2003/2004 rehabilitation, ponding of the water immediately outside the east end of the south dyke was observed.

The 2003/2004 rehabilitation program required draining of the existing lagoon, placement of a sufficient thickness of granular material to stabilize the accumulated sludge, placement of 0.3 m thick layer of sand, a geocomposite clay liner (GCL) and 0.3 m of surficial sand layer on top of the liner. Recompaction of the north dyke and raising of all perimeter dykes was also undertaken as part of the rehabilitation program.

July 2011 Site Visit

A visual review of the lagoon was undertaken. It revealed that the north berm is sliding downhill. A number of longitudinal cracks have developed in the downstream slope of the north berm. These cracks are parallel to the toe of the berm and are located in the bottom third height of the berm. In addition, some settlements of the crest of the berm were also observed.

The onsite observations confirm that the exterior slope of the north berm is unstable and prone to downhill movement. As indicated previously, in our report, the most likely cause of sliding of the north berm is seepage under the berm. The flow of subsurface water under the sewage lagoon is likely to have degraded the permafrost under the berm thereby causing settlements and cracking of the berm.

Two potential sources of subsurface flow have been identified, the subsurface flow of ground water and a leak in the lagoon liner. Either source or a combination of both sources could be contributing to the degradation of the permafrost under the berm.

Progressive degradation of the permafrost under the lagoon is expected due to the continuous flow of subsurface water under the lagoon. The flow of water in the drainage ditch located at the toe of the north berm would also degrade the permafrost close to the toe of the berm. It is therefore considered that merely repairing the reported leakage of the liner of the lagoon is not a solution to the problem.

It is considered that the berm is in a state of 'incipient' failure and measures should be undertaken as soon as possible to stabilize the berm. Any attempt to stabilize the berm by merely flattening the slope is not expected to be successful since steady seepage under the berm would result in continued cracking and downhill movement of the berm due to degradation of the permafrost until it eventually fails. However, temporary remedial measure of placing additional material close to the toe of the berm to create a bench is recommended since it will temporarily increase the stability of the berm.

The permanent remedial measures would likely involve prevention of subsurface flow of water under the treatment facility. This may be achieved by one of the following methods:

1. Installation of thermosyphons through the berms into the permafrost below in order to create an ice dam and thereby prevent seepage underneath the treatment facility.

2. Construction of a grout curtain underneath the berms to bedrock, which will prevent subsurface flow of water under the treatment facility.

3. Installation of impervious liner in the berms which is anchored into the permafrost below to prevent subsurface flow of water under the lagoon. This option is less desirable since degradation of the permafrost will not be prevented.

A fourth option is to abandon the facility and to construct a new facility at a suitable location.

In order to determine the most economical method of stabilizing the berm, a geotechnical investigation would be required to determine the geotechnical and groundwater conditions at the site, geotechnical properties of the fill used for construction of the berms, and those of the underlying natural soils, depth to permafrost and to bedrock, groundwater conditions at the site etc. It is recommended that the geotechnical investigation should be undertaken this year so that the remedial measures can be designed during the winter of 2011/2012 and implemented next year. If the geotechnical investigation is not undertaken this year, it would likely delay implementation of the remedial measures for at least one year, i.e. at least until 2013.

During the site visits of October 2010 and July 2011, ponding of the water close to the east end of the south berm and adjacent to the east berm close to its mid length was observed. It is recommended that this ponded water should be drained. This may be achieved by construction of a drainage ditch from the ponded area to the ravine located on the east side of the lagoon.

Should you have any questions, please contact this office.

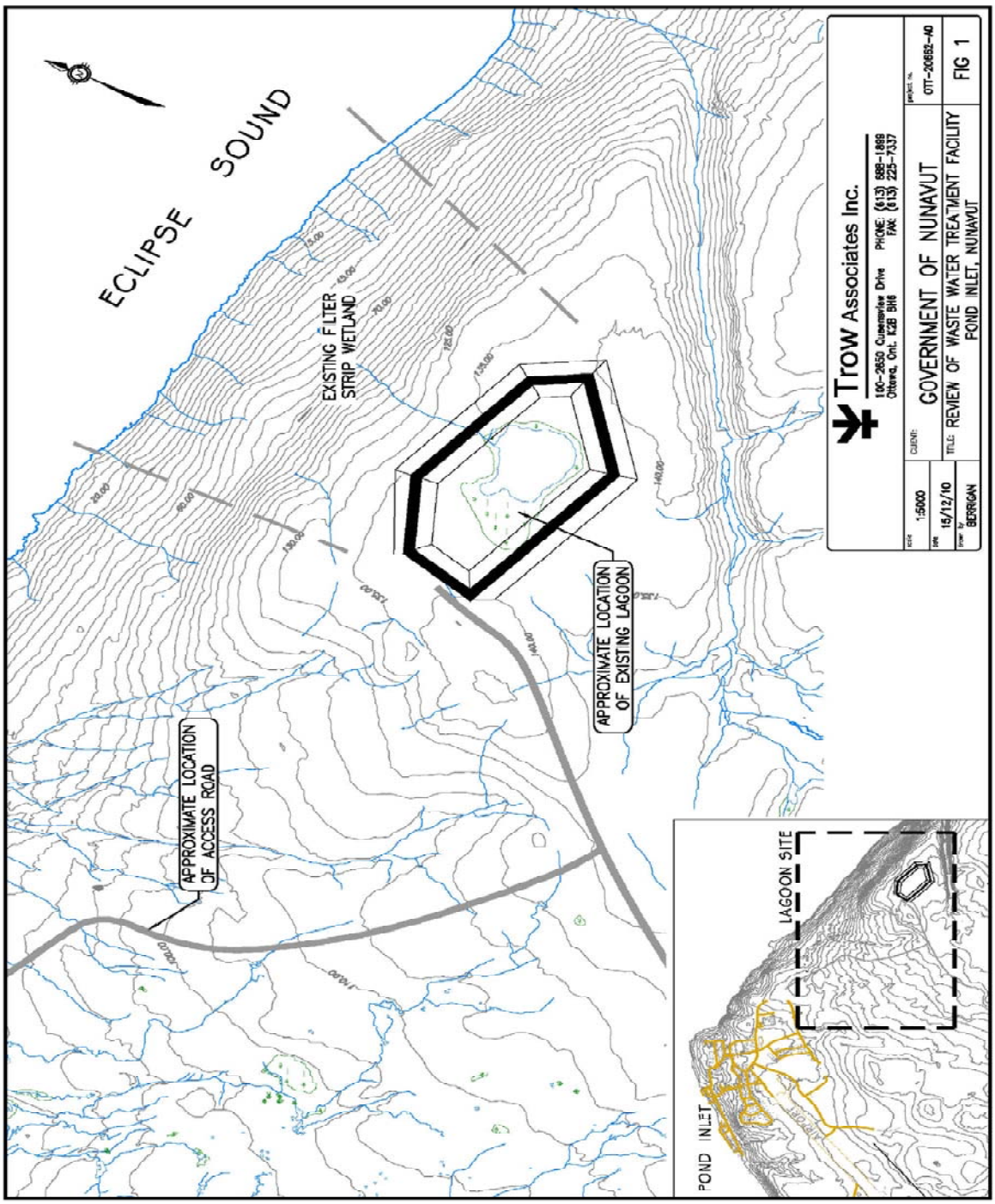
Sincerely,

exp Services Inc.

REGISTERED PROFESSIONAL ENGINEER
S.K. AGGARWAL
LICENSEE
NWT/NU

Surinder K. Aggarwal, M.Sc., P.Eng.
Senior Project Manager
Earth and Environment

Steven L. Burden, P.Eng.
Manager, Municipal
Infrastructure Services


ECLIPSE SOUND
EXISTING FILTER STRIP WETLAND
APPROXIMATE LOCATION OF ACCESS ROAD
APPROXIMATE LOCATION OF EXISTING LAGOON
POND INLET
LAGOON SITE
Trow Associates Inc.
100-2650 Queensview Drive Ottawa, Ont. K2B 8H6
PHONE: (613) 888-1888
FAX: (613) 225-7337
CLIENT: GOVERNMENT OF NUNAVUT
TITLE: REVIEW OF WASTE WATER TREATMENT FACILITY POND INLET, NUNAVUT
SCALE: 1:5000
DATE: 15/12/10
DRAWN BY: BERRIGAN
project no. OTT-20662-A0
FIG 1

exp Services Inc.

Company: Government of Nunavut
Re: Slope Inspection – Waste Water Treatment Facility
Pond Inlet, Nunavut
Project Number: OTT-00020662-A0
Date: July 18, 2011

Photographs

Photo 1: Longitudinal cracks in north berm at east end close to toe of berm.

Photo2 : Longitudinal cracks in north berm at east end close to toe of berm.

Photo 3: Longitudinal cracks in north berm extending from emergency flow to mid length of berm.

Photo 4: Longitudinal cracks in north berm extending from emergency flow to mid length of berm.

Photo 5: Longitudinal cracks in north berm extending from emergency flow to mid length of berm.

Photo 6: Longitudinal cracks in north berm extending from emergency flow to mid length of berm.

Photo 7: Longitudinal cracks in north berm extending from emergency flow to mid length of berm.

Photo 8: Longitudinal cracks in west half of the north berm close to toe of the berm.

Photo 9: Longitudinal cracks in west half of the north berm close to toe of the berm.

Photo 10: Longitudinal cracks in west half of the north berm close to toe of the berm.

Photo 11: Longitudinal cracks in west half of the north berm close to toe of the berm.

Photo 12: Longitudinal cracks in west half of the north berm close to toe of the berm.

Photo 13: Longitudinal cracks in west half of the north berm close to toe of the berm.

Photo 14: Longitudinal cracks in west half of the north berm close to toe of the berm.

Photo 15: Longitudinal cracks in west half of the north berm close to toe of the berm.

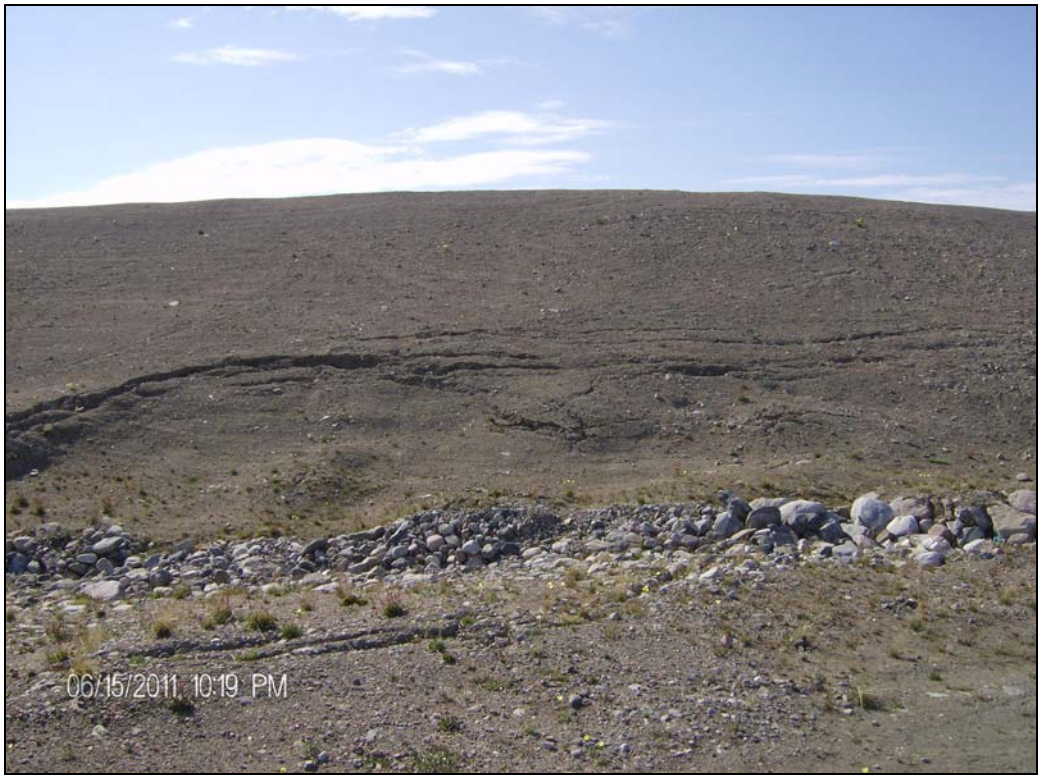


Photo 16: Longitudinal cracks in west half of the north berm close to toe of the berm.

Photo 17: Drainage ditch at toe of north berm.

Photo 18: Drainage ditch at toe of north berm.

Photo 19: Ponded water close to southwest corner of lagoon.

Photo 20: Ponded water close to southeast corner of lagoon.

Photo 21: Ponded water close to southeast corner of lagoon.

Photo 22: Ponded water close to southeast corner of lagoon.

Photo 23: Ponded water close to southeast corner of lagoon.