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TECHNICAL MEMO

TO:	Veronica Chisholm, DeBeers Andrew Williams, DeBeers	**DATE:**	May 3, 2012
C:	Wayne Corso, JDS Dan Johnson, JDS John Faithful, Golder	**MEMO NO.:**	101
FROM:	Bill Horne Hongwei Xia	**EBA FILE:**	E14101208
SUBJECT:	Gahcho Kué Geothermal Model - Information Request AANDC_22 Question 3 Response		

This technical memorandum summarizes the assumptions and uncertainties in the geothermal modelling outputs resulting from use of the existing ground thermal regime database in response to Question 3 in information request AADNC 22.

> *AANDC_22 Question 3.*
>
> *"Please describe any uncertainties in the geothermal modelling outputs resulting from use of the existing ground thermal regime database"*

A total of 34 thermistor cables were installed at the Gahcho Kué site in 2004 including three deep thermistors (up to 250 m), seven "on-land" cables, and 24 cables along proposed dyke alignments. Six readings were taken on most of the cables between April and August 2004 (De Beers 2010c, Appendices D.II, D.III, and D.IV.). The locations of ground temperature cables installed in 2004 are presented in Figure 1.

Bruce Geotechnical Consultants Inc. (BGC 1997) also carried out a ground thermal regime investigation for the AK 5034 Diamond Project in 1996 (now known as the Gahcho Kué 5034 Pit). Ground temperature readings were provided at four thermistor locations in the BGC study measured on a weekly basis over a four to seven month period. The data indicated that the ground temperature reached thermal equilibrium approximately one month after installation. The locations of ground temperature cables installed in 1996 are also presented in Figure 1.

The thermistor cables installed during the 2004 at the Gahcho Kué site were generally installed through February and April 2004, with the last ground temperature readings in August, 2004. The ground temperatures would have reached thermal equilibrium over this time. The existing ground temperature data can be used as a reasonable input for the thermal modelling and generally provides the necessary information for geotechnical and hydrologic studies. The ground temperatures at depth are considered to be reflective of the actual conditions. The shallow ground temperatures are only available for the late winter (April) and mid-summer (August). Some additional ground temperatures are available from the other months from the BGC 1997 study.

A thermal calibration analysis was carried out by EBA as part of thermal study of proposed fine PK facility in Area 2. Detailed model methodology and input parameters could be found in the response to AANDC

15-1. Two sets of ground temperatures on May 1, 2004 and August 11, 2004 at MPV-04-194C were compared as shown in Table 1.

Table 1: Measured and Predicted Ground Temperatures at MPV-04-194C.

Depth below Ground Surface (m)	Measured on May 1, 2004 (°C)	Predicted on May 1, 2004 (°C)	Measured on August 11, 2004 (°C)	Predicted on August 11, 2004 (°C)
-0.5	-8.5	-8.7	5.5	7
-2.5	-6.5	-6.3	-1	-1.1
-5	-4.5	-4	-3	-2.7
-7.5	-3.25	-2.8	-3.4	-3.2
-10	-2.6	-2.3	-3.2	-3
-12.5	-2.5	-2.4	-3.1	-2.7
-15	-2.5	-2.6	-2.8	-2.65
-17.5	-2.6	-2.7	-2.75	-2.63
-20	-2.75	-2.7	-2.75	-2.6

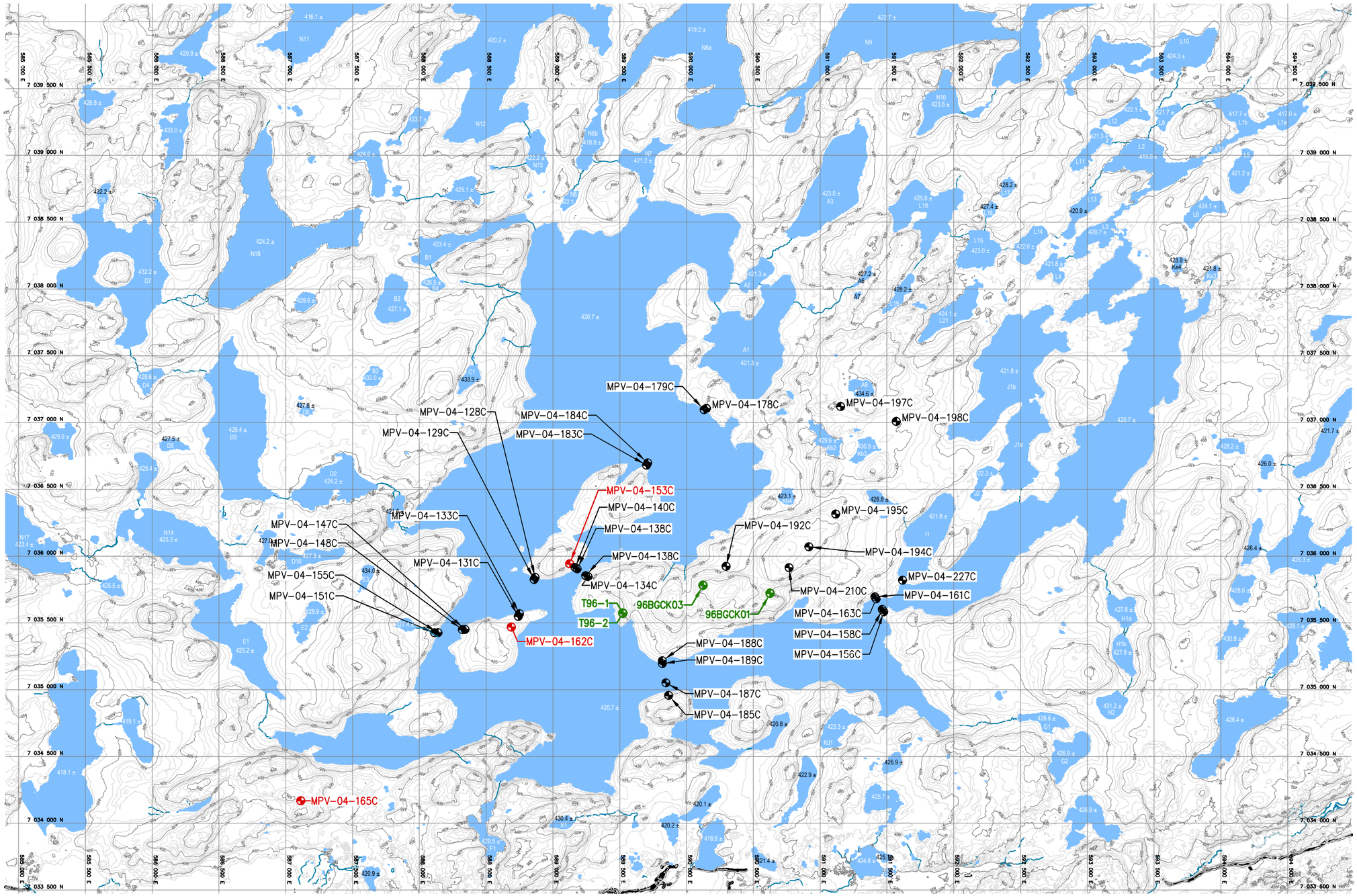
Agreement was obtained between the measured and predicted ground temperature data, which suggests that the ground temperature data provides a reasonable basis for thermal modelling and input parameters are reasonable. There is a high level of confidence that the available ground temperature data is adequate and a low risk that uncertainties in the data will have any significant impacts in the Project performance.

Most of the earth structures designed for the Project do not rely on the presence of permafrost and permafrost performance, with the exception of specific dykes (Dykes A1, D, E, F, and G). For structures relying on the permafrost condition, ground temperature cables will be installed during the detailed site investigation at the final design stage. Regular readings will be taken to facilitate the final engineering design and further thermal evaluation. A monitoring program will be setup to monitor the thermal performance of the earth structures during the mine operations. Results of these monitoring programs will be used to evaluate how ground temperatures may be changing during project construction, operation, and reclamation. Adaptive management will be implemented as required.

REFERENCES

BGC 1997. AK 5034 Diamond Project Ground Thermal Regime Report. A technical report submitted to Canamera Geological Ltd. by BGC.

De Beers (De Beers Canada Inc.). 2010. Environmental Impact Statement for the Gahcho Kué Project. Annexes D.II, D.III and D.IV. Submitted to Mackenzie Valley Environmental Impact Review Board. December 2010.



LEGEND:

- EXISTING GROUND CONTOURS, 5 m INDEX - 1 m INTERMEDIATE
- BATHYMETRY CONTOURS, 5 m INDEX - 1 m INTERMEDIATE
- GTC LOCATION (AMEC 2004)
- DEEP GTC LOCATION (AMEC 2004)
- GTC LOCATION (BGC 1997)

0 1 000 m

Scale: 1: 30 000

NOTES
- ZONE 12, UTM NAD83 PROJECTION CENTRED ON 111°

STATUS
ISSUED FOR USE

CLIENT

De Beers Canada

Mountain Province Diamonds Inc.

GAHCHO KUÉ DIAMOND PROJECT
NWT, CANADA

GROUND TEMPERATURE CABLE (GTC) LOCATIONS

PROJECT NO.	DWN	CKD	REV
E14101208	DBD/EL	HX	0
OFFICE	DATE		
EDM	May 3, 2012		

Figure 1

IBS Energy & Mining Inc.

eba A TETRA TECH COMPANY

Q:\Edmonton\Drafting\CIVIL3D\E14\E14101208\2_Report Components\Autocad\Technical Memo-May 5_2012\E14101208_FIG 1-R0.dwg [FIGURE 1] May 03, 2012 - 10:05:39 am (BY: LEE, ELVIN)