DE BEERS
CANADA
GAHCHO KUÉ PROJECT

August 9, 2012

File: S110-01-10

Chuck Hubert
Senior Environmental Assessment Officer
Mackenzie Valley Environmental Impact Review Board
Suite 200, 5102 – 50th Avenue
PO Box 938
Yellowknife NT X1A 2N7

Dear Mr. Hubert:

Natural Resources Canada – Round 2 Information Request
Responses - Gahcho Kué Project Environmnental Impact Review

De Beers is pleased to provide the Mackenzie Valley Environmnental Impact Review Board with responses to Round 2 Information Requests submitted by Natural Resources Canada.

Sincerely,

Veronica Chisholm

Veronica Chisholm
Permitting Manager

Attachment

c: J. King, Senior Policy Analyst, Natural Resources Canada

Round 2 Information Request Number: NRCan 2-1

Source: Natural Resources Canada (NRCan)

Subject Permafrost and Terrain Conditions

References: TOR Sections: 3.1.2; 3.1.3.

2012 EIS Supplement Section 1.3 Project Overview, 3, 8, 11

Preamble and Rationale

During the technical session, the Proponent indicated that dyke A1 and dyke D would function more as berms at closure and would not be water retaining structures.

The maps provided in the 2012 EIS supplement (in Figure 1.3-2 and 3.12-1) shows dyke A1 crossing streams between Area 2 and lakes A2 and A1 (Area 1). It appears that lake levels would rise because drainage from these lakes to Kennady Lake Area 2, which then becomes fine Processed Kimberlite PK facility, is being cut off to facilitate dewatering.

Figure 3.12-1 appears to show that at closure dyke A1 would still have water behind it, resulting in consequences for the ground thermal regime and stability if the dyke is keyed into permafrost.

Request

Please provide clarification on whether there will be water impounded behind dyke A1 during operation and at closure and the implications for the thermal regime and stability of dyke A1.

Response

Dyke A1 will be constructed between Area 1 and Area 2. Fine PK will be deposited in Area 2 against Dyke A1, while water will remain in Lake A1. The water level will be allowed to rise in Lake A1 from its original level of 421.3 m to approximately 423.0 m. As such, Dyke A1 will be a low head structure with minimal stability issues. Any seepage would be *from* Lake A1 into Kennady Lake (Area 2/3). At closure, Lake A1 (Area 1) will be connected to Kennady Lake (Area 3) via a natural overflow channel at the southern end of Lake A1. At this time Dyke A1 will form the western boundary of Lake A1, and hence, acts as a diversion berm rather than a water retaining structure.

Dyke A1 is proposed to be constructed to a crest elevation of 425.5 m. At closure the western side of the Dyke A1 will filled with cover material so there is no water head (or ponded water) against the Area 2 side of Dyke A1.

The final design of Dyke A1 will be a function of the geotechnical conditions underlying Dyke A1. The geotechnical conditions will be further investigated prior to the final design being completed. Detail design will evaluate the influence of the Lake A1 adjacent to the Dyke A1. If the analyses and geotechnical conditions indicate thermal stability is an issue, the design will be developed accordingly to prevent thermal stability from impacting the dyke performance.

Round 2 Information Request Number: NRCan 2-2

Source: Natural Resources Canada (NRCan)

Subject: Geology – Paragneiss in Kennady Lake area and its acid generating potential

References: TOR Sections 3.1.2; 3.1.3. 2012 EIS Section 11.6 Permafrost Groundwater and Hydrogeology subsection 11.6.2.2.1 Bedrock Geology

Preamble and Rationale

The major lithological units in the Kennady Lake area are granite and gneissic granite with minor components of meta-sedimentary rocks (paragneiss). The minor components are not shown on Figure 11.6-4 (for obvious scale limitation of the map), but they are clearly identified in Figure 11.6-5 as paragneiss (in shades of orange and pale brown). Since the bedrock is poorly exposed in the vicinity of the Kennady Lake mine site, their occurrence and regional extent appear to have been based on bedrock geology interpreted from geophysical datasets, and by extrapolation of the units from the northeast and southwest of Kennady Lake (a valid interpretation). Although the paragneiss is known to occur as regionally pervasive inclusions, rafts, and xenoliths of variable size and extent within the dominant granite and granitic gneiss units in this part of the Slave craton, the interpreted geology map (Figure 11.6-5) shows that substantial region in the Kennady Lake project area may be covered by paragneiss in subsurface (above the kimberlite pipes) as well as on land portions adjoining Kennady Lake), and contribute to the overburden budget.

It is not clear from the EIS document whether any geochemical analysis of the paragneiss has been carried out by the proponent to determine its acid generating potential. In Section 3.7.3.2 *(Geochemical Characterization of Mine Rock; Table* 3. 7-7), the paragneiss is not listed as a rock type tested for its acid generating potential. The paragneiss may contain additional contaminants. The metal leaching, sulphur content, and acid factor aspects of this rock type may potentially affect/increase the total estimates of these parameters as reported in the EIS document, and likely to impact on the mine waste (overburden) management.

It is uncertain whether the paragneiss in the Kennady Lake area (Figure 11-6.5; Section 11-6.2), has been sampled, analyzed and assessed for its acid generating potential.

Request

Please clarify if the paragneiss in the Kennady Lake area (Figure 11-6.5; Section 11-6.2) has been sampled, analyzed and assessed for its acid generating potential.

Response

Figure NRCan 2-2-1, also presented in Section 11.6 of the 2010 EIS (De Beers 2010, Section 11.6, Figure 11.6-5) is an illustrative geological interpretation of the Kennady Lake Area constructed by SRK Consulting in 2004, based on Aeromagnetic Data (SRK 2004; De Beers 2010). The figure identifies four primary lithologies, including two granitoids and two paragneiss units. The 2004 interpretation, as presented in Figure NRCan 2-2-1, suggests that paragneiss units underlie the proposed Gahcho Kué Project (Project) site; however, this definition was based on aerial data and inferences from similar “looking” regional information (De Beers 2010).

The identification of the “paragneiss” as a widespread unit is not supported by Figure NRCan 2-2-2 also presented in Section 11.6 of the 2010 EIS (De Beers 2010, Section 11.6, Figure 11.6-4), which is a larger scale map of the region created by geological field mapping on the ground (De Beers 2010). The areal extent of Figure NRCan 2-2-1 is described in Figure NRCan 2-2-2 as being underlain by primarily potassium-feldspar megacrystic granite and biotite-muscovite monzogranite, with minor migmatite and tonalite. The large scale of Figure NRCan 2-2-2 may have resulted in the omission of minor lithological units for the sake of simplicity; however, several minor units, including tonalite, extend over a substantially smaller area than the paragneiss and remain represented in Figure NRCan 2-2-2 (De Beers 2010, Section 11.6). The discrepancy between the two figures highlights the possible variability in identification of geological units and their extent in the field, and/or differences in interpretation and opinion between the different geologists involved in their preparation. The figures referencing these units should be used for overall context, whereas the drill core data and detailed logs collected from drilling and core-logging activities associated with geochemistry and hydrogeological sampling programs that have been referenced in the 2010 EIS and 2012 EIS Supplement, are considered to be more representative of the materials that will actually be encountered during the mine operation (De Beers 2010, 2012).

Although the 2004 mapping is still useful for geological context, and as such is presented in the 2010 EIS, the drilling and core-logging data are considered more reliable indicators of the actual geology underlying the Project (De Beers 2010). The mine rock material geochemical sampling program to obtain drill core samples and analyze core samples was conducted to characterize the geochemical properties of both major and minor lithological units that may be displaced during mining construction, operations or closure.

The selection of samples was conducted according to Price (1997), and was described as follows in Appendix 8.III, Attachment 8.III-3 of the 2012 EIS Supplement (De Beers 2012):

> *"The objective of this geochemical program was to choose representative samples of all the different types of materials that will be excavated or exposed at the Project site. Sample collection began during the 2004 winter drilling program and continued through July 2008. In 2004, discrete samples were collected every 6 m of drilled core length. Sampling in subsequent years was changed to discrete samples every 6 m for mine rock and 12 m for kimberlite. Locations of each of the drill holes used for collecting geochemical samples are shown in Attachment 8.III.1."*

The drill hole locations selected for the sampling program cover the proposed extent of mining for the proposed Project, and extend over the area identified as 'paragneiss' in Figure NRCan 2-2-1 (De Beers 2010, Section 11.6). No paragneiss was identified in any of the drill core samples at any depth, and the data clearly show that the units identified as 'paragneiss', are actually comprised of granite with minor granitic gneiss (orthogneiss), altered granite, diabase, diorite and granodiorite, all of which have been analysed for ARD potential and comprise part of the overall assessment. Based on the units observed during the drilling program and the location of the drill holes, the geochemical program captured the major and significant minor mine rock lithological units expected to be displaced during mining. The results of the geochemical sampling program are presented in detail in Appendix 8.III of the 2012 EIS Supplement, and summarized in Section 3.7 (Project Description) of the 2012 EIS Supplement (De Beers 2012).

In addition to the drill holes sampled in the geochemical sampling program, several boreholes were drilled on the site and the cores logged as part of the site hydrogeological investigation, which is described in Section 11.6 and Annex G of the 2010 EIS (De Beers 2010). The location of these boreholes is shown in Figure 11.6-3, and the borehole logs are included in Annex G, Appendix G.VI of De Beers 2010. Several boreholes, including MPV-04-166C, 167C, 135C, 206, 192, 141C, 118C, 153C, 177C, 176C, 127C, 172C, 236C, 197, 195, 194 and 182C are located over the extent of the 'paragneiss' units, as described in Figure NRCan 2-2-1 (De Beers 2010, Section 11.6 and Annex G). The borehole logs do not confirm the existence of paragneiss in the subsurface, and identify the bedrock in this region as consisting primarily of granite, gneissic granite (orthogneiss) and kimberlite, with minor mafic dykes.

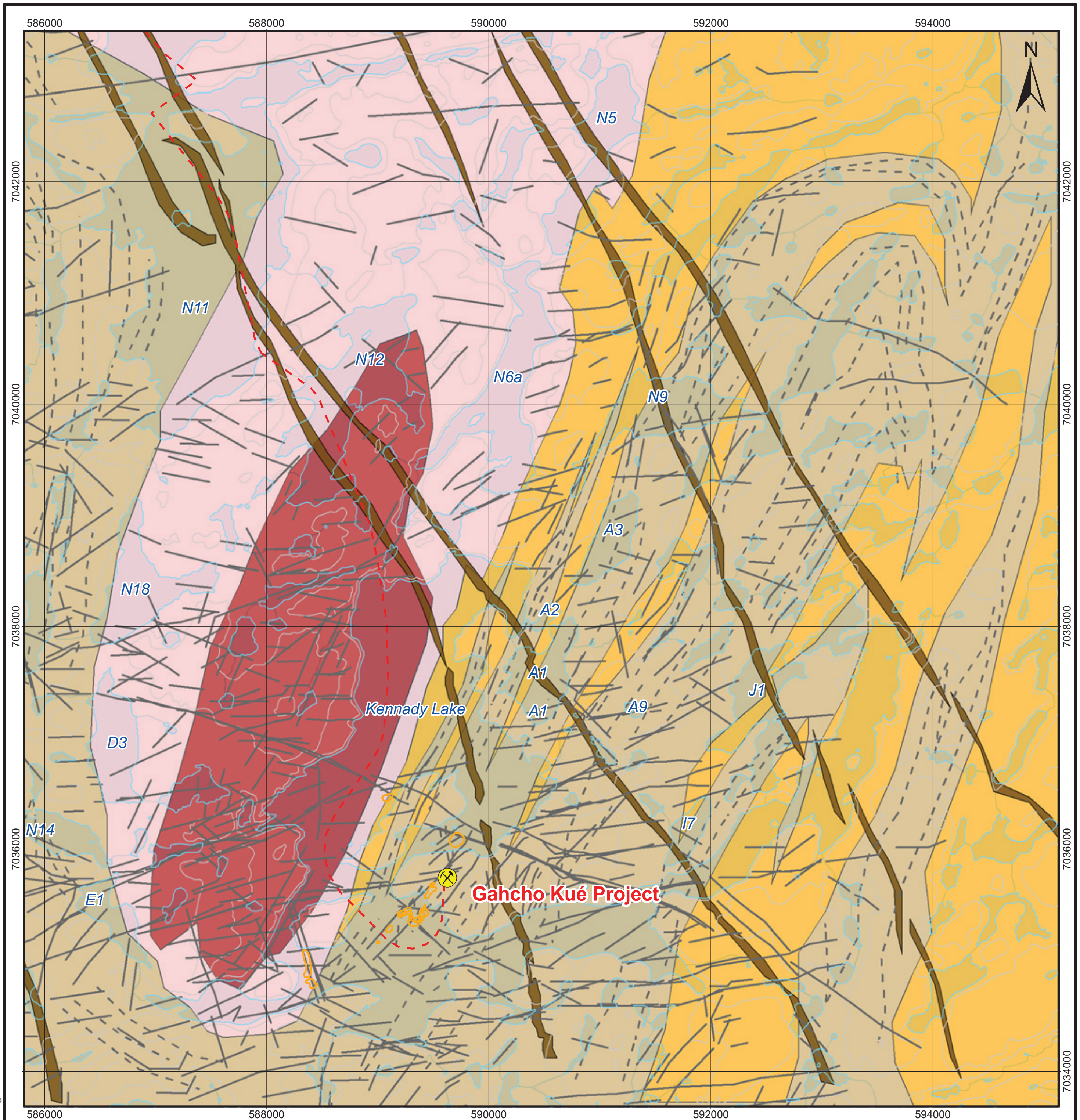
References

De Beers (De Beers Canada Inc.). 2010. *Environmental Impact Statement for the Gahcho Kué Project. Volumes 1, 2, 3a, 3b, 4, 5, 6a, 6b, 7 and Annexes A through N.* Submitted to Mackenzie Valley Environmental Impact Review Board. December 2010.

De Beers. 2012. *Environmental Impact Statement Supplemental Information Submission for the Gahcho Kué Project*. Submitted to the Mackenzie Valley Environmental Impact Review Board. April 2012.

Price, W.L. 1997. *Draft Guidelines and Recommended Methods for the Prediction of Metal Leaching and Acid Rock Drainage at Minesites in British Columbia*. British Columbia Ministry of Employment and Investment, Energy and Minerals Division: Victoria, BC, Canada

SRK (SRK Consulting (Canada) Inc.). 2004. *Gahcho Kué Diamond Project – Mining Geotechnics*. Prepared for De Beers Canada Ltd. November 2004.



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LEGEND

- Gahcho Kué Project
- Winter Access Road
- Watercourse
- Contour (10m interval)
- Waterbody
- Brittle Structure
- Magnetic Fabric
- Dyke
- Kimberlite Outline

Geological Interpretation

- Granitoids Diorite
- Granitoids Gabbro
- Paragneiss - Strong
- Paragneiss - Weak

NOTES
Base data source: National Topographic Base Data (NTDB) 1:50,000
Geological data source: Based on Aeromagnetic Data SRK, 2004

GAHCHO KUÉ PROJECT

Geological Interpretation of the Kennady Lake Area

PROJECTION:	DATUM:
UTM Zone 12	NAD83

Scale: 1:50,000
1 0.5 0 1
Kilometers

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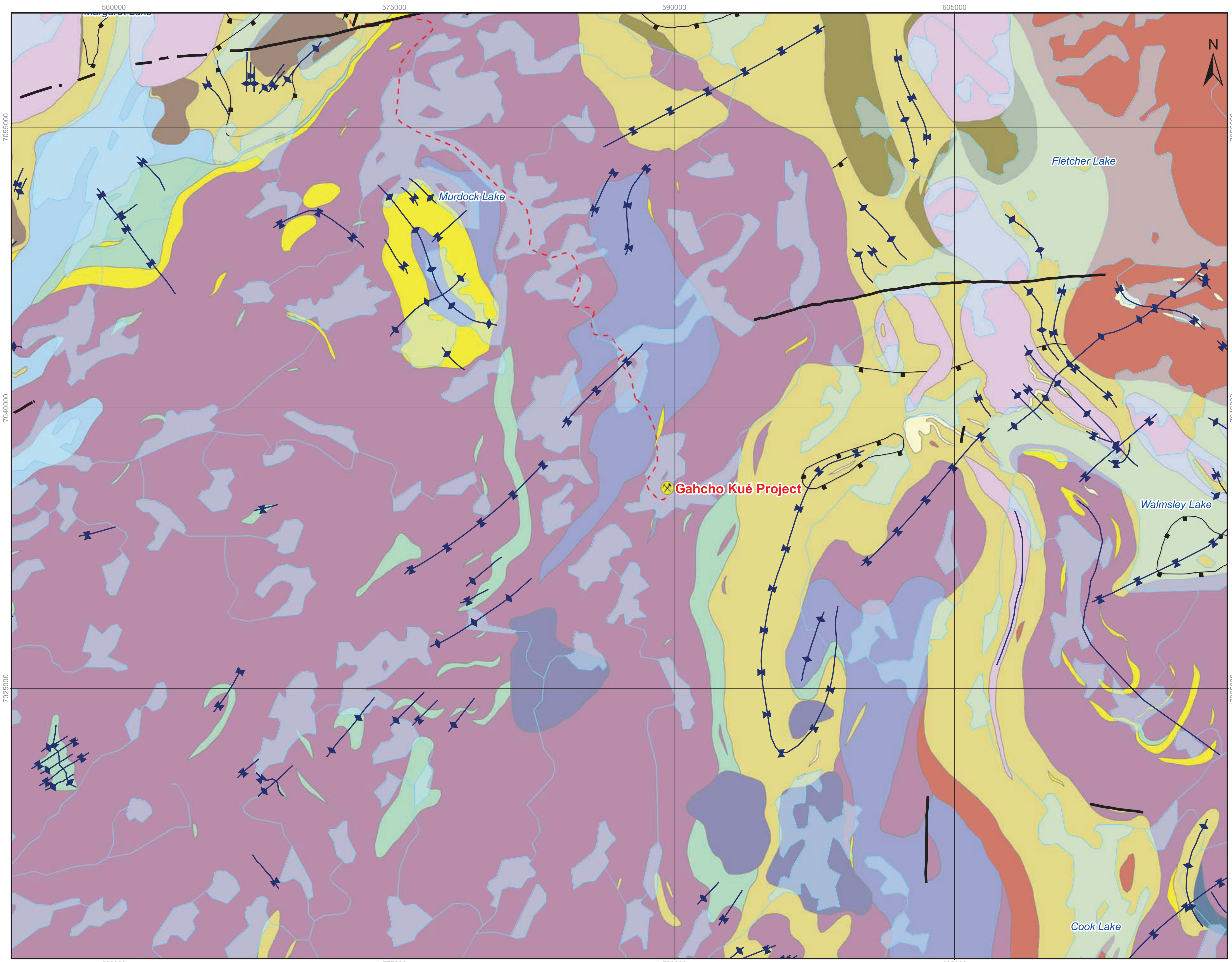
FILE No:	DATE:
B-Hydrogeo-003-GIS	October 22, 2010

JOB NO:	REVISION NO:	
09-1365-1004	8	
OFFICE:	DRAWN:	CHECK:
GOLD-CAL	JH	DC

Figure NRCan 2-2-1



LEGEND

- Gahcho Kué Project
- Watercourse
- Waterbody
- Winter Access Road
- Faults
- Fold Trace - Antiform
- Fold Trace - Synform
- Fold Trace Lines
- Isograds in Pelite

Bedrock Geology

- Banded hornblende +/- garnet amphibolite
- Biotite +/- muscovite granite
- Biotite>Muscovite Monzogranite
- Diorite
- Gabbro to gabbronorite
- Granitic pegmatite
- Greywacke and Mudstone
- Hornblende granodiorite
- Hornblende tonalite
- Injection migmatite
- Intermediate to mafic volcanic rocks
- K-feldspar megacrystic granite
- Pyroxenite
- Quaternary cover
- Tonalite to granodiorite
- Trondhjemite
- Undifferentiated metavolcanics

NOTES
Adapted from: Cairns,S.R., MacLachlan,K., Relf,C., Renaud,J., and Davis,W.J. 2003. Digital Atlas of the Walmsley Lake Area, NTS 75N. C.S. Lord Northern Geoscience Centre, Yellowknife, NT. Open file Report 2003-04. CD ROM.
Base data source: National Topographic Base Data (NTDB) 1:50,000

GAHCHO KUÉ PROJECT

Bedrock Geology of the Kennady Lake Region

PROJECTION: UTM Zone 12
DATUM: NAD83

Scale: 1:200,000
4 2 0 4
Kilometres

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FILE No: B-Hydrogeo-002-GIS
DATE: October 22, 2010
JOB NO: VE51664
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Figure NRCan 2-2-2

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